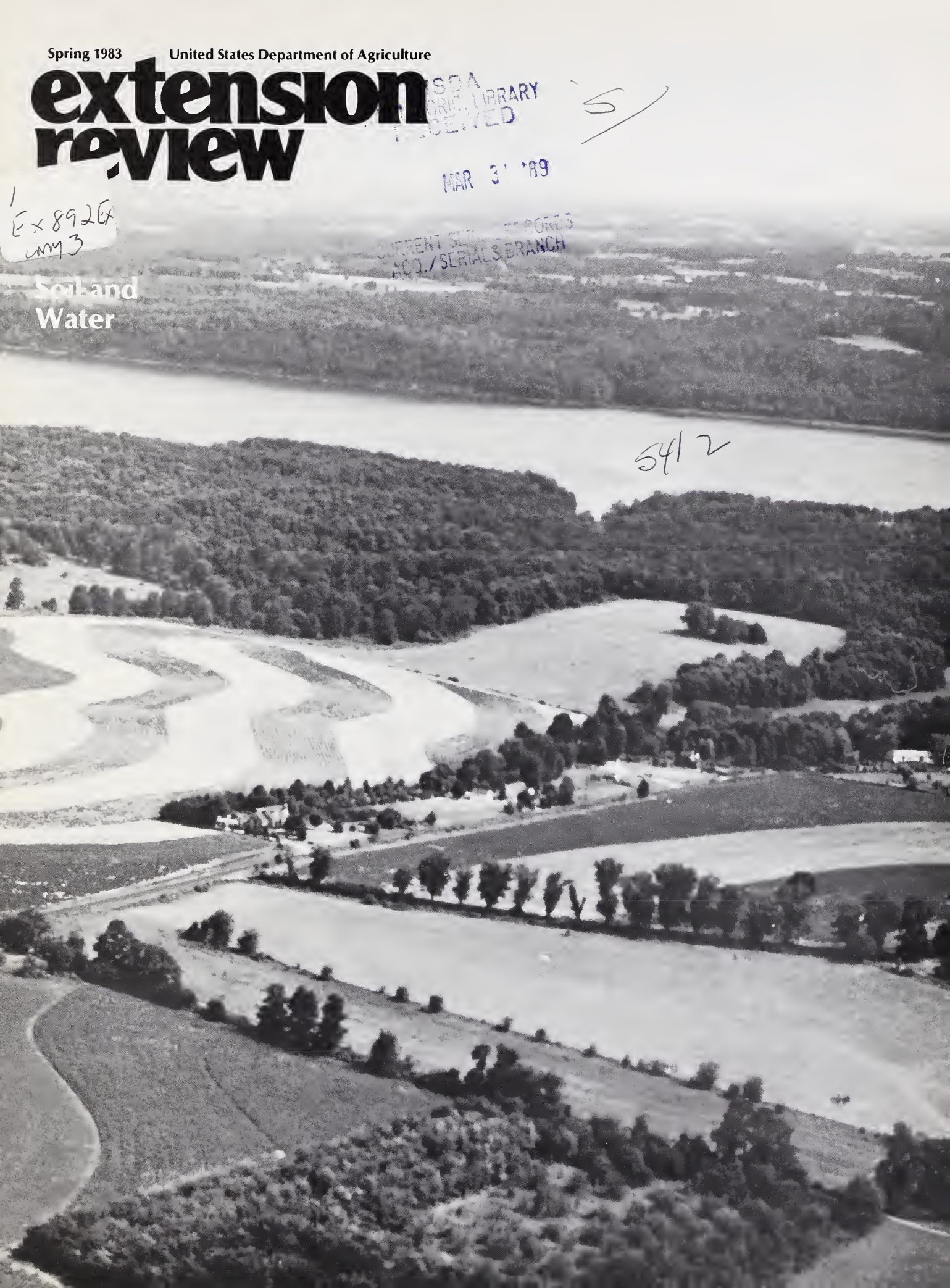
Spring 1983 United States Department of Agriculture

extension review

Soil and Water



review

Extension in the 80's

Mary Nell Greenwood
Administrator
Extension Service, USDA
and
Lucinda Noble
Director
Cooperative Extension, New York
and Chairman, ECOP

National Teleconference participants at Washington, D.C., reporting on "Extension in the 80s" were (left to right): Denzil Clegg, Associate Administrator, Extension Service, USDA; Lucinda Noble, Chairman, ECOP, and Director, Cooperative Extension, New York; Dan Aldrich, Jr., Chancellor, University of California-Irvine; Robert Clodius, President, National Association of State Universities and Land-Grant Colleges; George Brown, Representative, California; and Ray Lett, Executive Assistant to the Secretary of Agriculture.

Mary Nell Greenwood, Administrator, Extension Service.

"Extension in the 80s, A Perspective for the Future of the Cooperative Extension Service," represents a systemwide response and set of guidelines to the challenge of rapid change. The report contains results of a year-long study by the 21 members of a Joint Committee appointed by John Block, Secretary of Agriculture, and Robert Clodius, President, National Association of State Universities and Land-Grant Colleges.

Future Role for Cooperative Extension
The Committee's charge was to produce a document to serve as a guide for the future mission, scope, priorities, and policies and to review and restate the roles and responsibilities of each of the partners—federal, state and county—in the Cooperative Extension system.

The Committee received inputs from many groups and individuals in writing and in open hearings. It received responses from an extensive mail survey with returns from nearly 4,500 leaders and individuals from the private sector and 14,000 Cooperative Extension Service professional staff nationwide.

The official report was made to Secretary Block and President Clodius on February 28, 1983, in Washington, D.C. Cochairs of the Committee, who presented the report were Ray Lett, Executive Assistant to the Secretary, and Daniel Aldrich, Jr., Chancellor, University of California—Irvine.

Selected Recommendations and Guidelines for Cooperative Extension formulated by the National Committee include:

Mission—The basic mission of Cooperative Extension is to disseminate, and encourage the application of research-generated knowledge and leadership techniques to individuals, families, and communities... Dissemination of research knowledge and the application of that knowledge to practical problems is as important now as in the past.

Priorities—The Cooperative Extension system must establish priorities within six major program areas... the agricultural system, natural and environmental resources, community and small business development, home economics/family living, 4-H/youth education and development, and international concerns.

Clientele—Ways must be found to reach more people with educational programs... Much sharper delineation of target audiences is needed.

Flexibility—Cooperative Extension programming must retain broad flexibility at all levels if it is to remain relevant and respond to the dynamics of change for the greater good of people and their communities...

Federal/State/County Partnerships—The importance of linkages among the Service, all three levels of government and America's community leaders was reaffirmed.

Research—Research should remain the base for the system's major educational and information efforts... Additional resources are needed for applied research and demonstrations, which are essential for effective technology transfer.

Extension in Land-Grant Universities—Administrators and faculty of land-grant universities must place lifelong learning on a plane equal to that of research and preparatory education... A tested system exists for extending knowledge about agriculture, home economics, and natural resources to local communities throughout the nation.

Volunteers—Some 1.5 million adult volunteers perform numerous roles under the guidance of Extension professionals. This volunteer system deserves encouragement from all three legal partners as it is basic to the success of Cooperative Extension in America.

Private Sector—At the national level, the private sector provides major resources through national foundations, corporations, and individuals... The legal partners should continue to recognize and encourage this commitment.

Methodology—Cooperative Extension is encouraged to use new electronic technology in providing viable educational opportunities to expanded audiences.

Evaluation—Cooperative Extension must involve the public and decision-makers in Extension evaluation efforts; by such activity, these people will come to understand Extension better.

A Unique Achievement
The Cooperative Extension Service is a unique achievement in American education. The system has been a major asset to the nation and to the world. If changes recommended by the Committee are adopted, the Cooperative Extension Service will, the Committee believes, be able to play a larger and more vital role in the years that lie ahead. □

contents

extension review

Vol. 54 No. 2
Spring 1983

John R. Block
Secretary of Agriculture

Orville G. Bentley
Assistant Secretary for Science and Education

Mary Nell Greenwood
Administrator
Extension Services

The *Extension Review*, quarterly publication of the Extension Service is for Extension educators in county, state and USDA agencies. The Secretary of Agriculture has determined that the publication of this periodical is necessary in the transaction of the public business required by law of the Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through September 30, 1985. The Review is issued free by Law to workers engaged in Extension activities. For sale by the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Send manuscript inquiries to: The Editor, Extension Service, Room 3135-S, USDA, Washington, D.C. 20250. Telephone (202) 447-4651.

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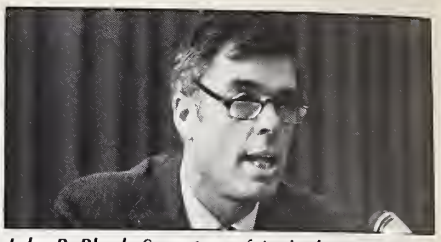
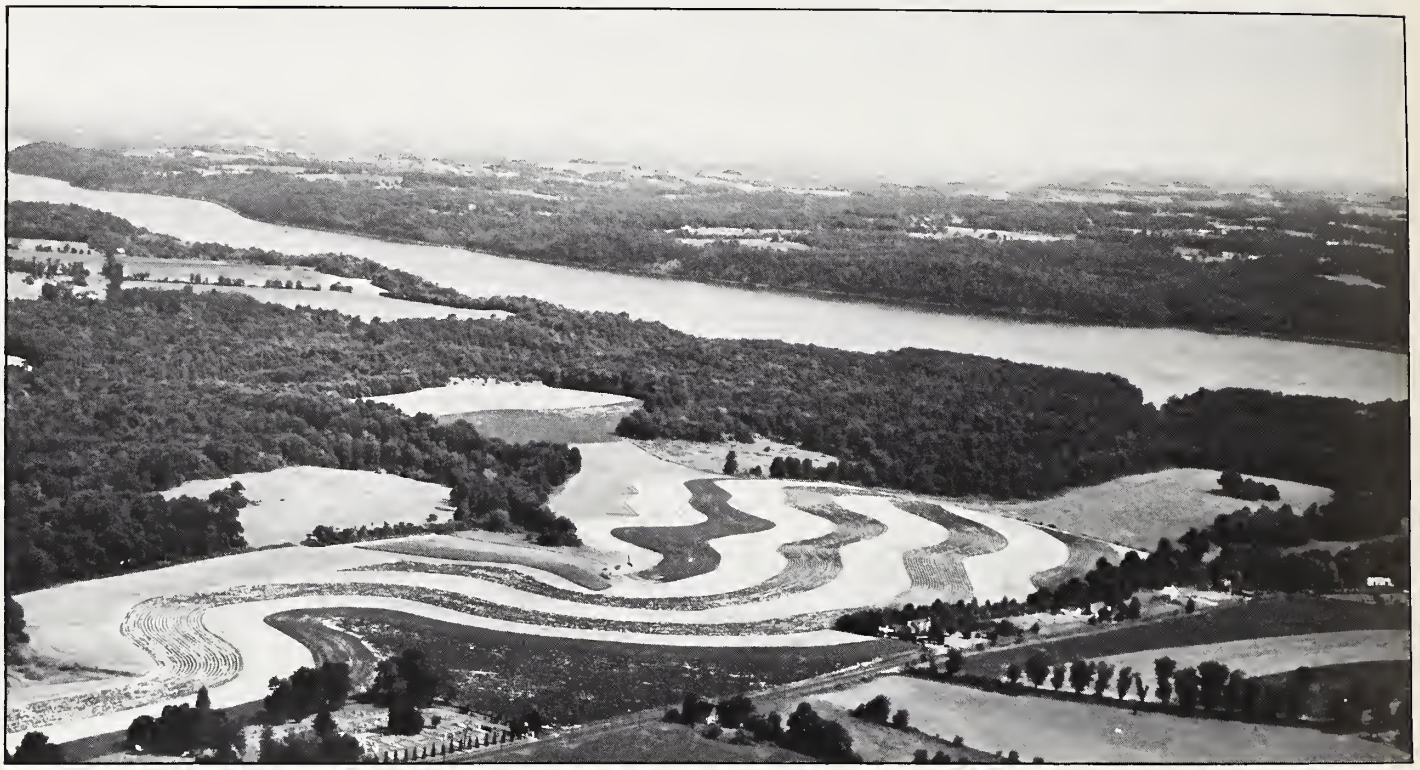
Cover: Conservation farming near the Susquehanna River in Harford County, Maryland. (Credit USDA–Soil Conservation Service.)

Soil and Water Resources—The Challenge to Extension

John R. Block
Secretary of Agriculture



John R. Block, Secretary of Agriculture.



Cooperative Extension has long been recognized for the major influence it has had in developing the agricultural production system which so many of us take great pride in today. This recognition is richly deserved.

Cited by many as a model for technology transfer programs, the Cooperative Extension system is unique in its effectiveness and cooperation. A three-way federal, state and local partnership supports Extension, provides program direction, infuses it with innovation and enthusiasm, and provides many volunteer leaders who contribute greatly to the effectiveness of the programs and the efficiency of the system.

We can look to the past and find many accomplishments by Extension. But by its very nature, the Extension system is a forward-looking service to American agriculture. The achievements have been great, but the challenges ahead are even greater.

One such challenge is to make ourselves fully aware of the impacts which technology transfer programs have upon some of our most basic resources—soil and water. How can the Cooperative Extension system develop and deliver programs to educate and influence citizens to make wise use of these basic resources?

Shortly after being confirmed as Secretary of Agriculture, I established a list of departmental priorities, two relating particularly to the Extension Service and the Cooperative Extension system. Those two priorities were to maintain agricultural productivity and conserve natural resources.

As the educational arm of USDA, Extension has an important responsibility in the conservation of soil and water resources. It complements the roles of two other USDA agencies in soil and water conservation—the Soil Conservation Service and the Agricultural Stabilization and Conservation Service.

Outside the Department, the Extension Committee on Organization and Policy has recognized the need for such complementary programming. Further, the recently published report, "Extension in the 80's—A Perspective for the Future of the Cooperative Extension Service," referred to in this issue's editorial, has also suggested increased emphasis on these subjects.

Programs in soil and water resource conservation are needed. They are important! As one reflects on the extraordinary success of the Extension system in the development of U.S. agricultural productivity, the question arises: What would happen if the Extension system were to mount an all-out response to the challenges of conservation?

Results from such an emphasis would likely be every bit as remarkable as those we see in our agricultural production programs. I personally believe that in time Extension can and will achieve such results in conservation as it rises to the challenge. □

Reclaiming the Land

William C. Burleson
Extension Information Director
Virginia Polytechnic Institute and State University

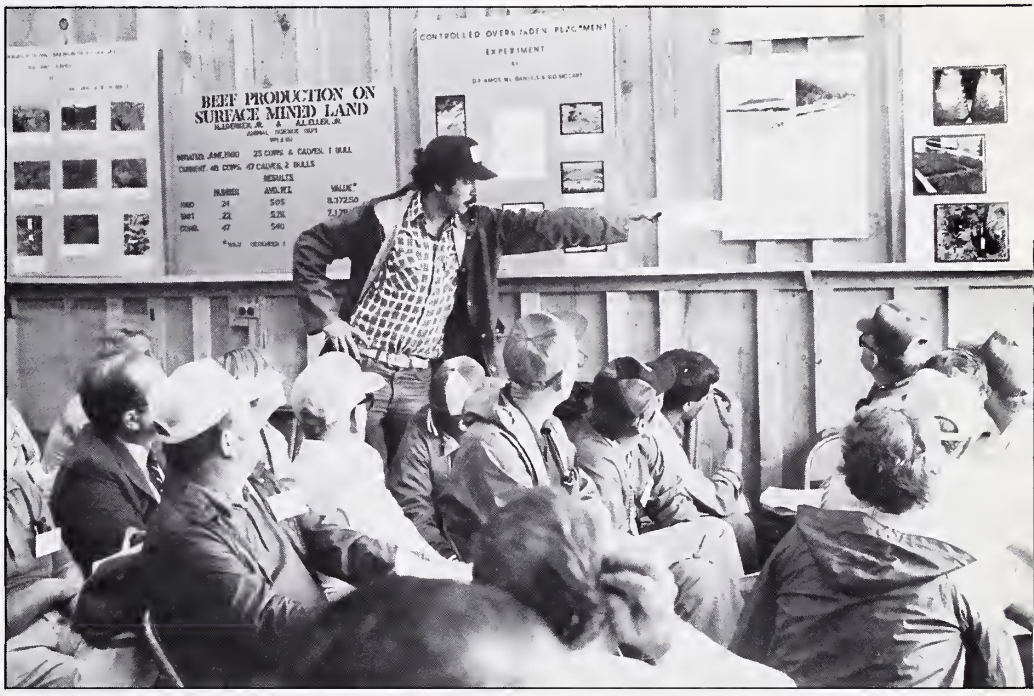
Lack of usable land is hindering the economic growth of the coal-producing counties in southwest Virginia. For years the mountains that have yielded the coal on which these counties' economies depend also have served as barriers against further economic development.

The mountain barriers may be coming down, however. Virginia Tech, through its Extension and research arms, is cooperating with private industry, two other area colleges and local, state and federal agencies in what may be the answer to this problem—the Southwest Virginia Project. This project is showing promise of making valuable additions to the region's economy by finding new uses for the land after the coal has been removed.

The Southwest Virginia Project, now in its third year, became a reality in 1980 when Penn Virginia Corp., a natural resources and equipment firm with its natural resources office in Duffield, Va., provided $500,000 in grants to Tech. It also made available 1,200 acres of reclaimed mined land at the headwaters of the Powell River in Wise County for the research and assigned three employees to work at the project site.

Beginnings
The project stems from talks in 1979 between C.B. Slemp, Penn Virginia land manager and now project director, and Milton B. Wise, associate dean for Extension in Tech's College of Agriculture and Life Sciences. Slemp, a native of the region, was concerned about finding uses for the surface-mined land after the coal was removed.

These talks resulted in more than a dozen research projects being conducted on the surface-mined land to find ways to make it productive and beneficial to the area's residents. H. John Gerken, Jr., Tech Extension specialist, became project coordinator.



A Virginia Tech (VPSU) graduate student outlines recent land reclamation research for coal producers from various states.

The project could mean millions of dollars of revenue for those Virginia, West Virginia and Kentucky counties that have had extensive surface mining during the last four decades. Early indications are that the land, once thought unusable, can be an asset to the local economy. Several coal companies have expressed an interest in the work, indicating they may be willing to fund additional research at the site. Several national, regional and local groups have toured the project site to learn first hand about the work. Extension is using the research results in areas with similar problems.

Advisory Council Cooperation
At the same time that the Tech researchers began looking at ways to productively use the land, Wise helped form a project advisory council which includes all segments of the political spectrum.

He chairs the council which includes representatives from Congress and the Virginia state legislature, the Tennessee Valley Authority, Office of Surface Mining Reclamation and Enforcement, Division of Mined Land Reclamation, Virginia Department of Agriculture and Consumer Services, and Virginia Department of Conservation and Economic Development.

Higher education, in addition to the Extension and research components in agriculture and engineering at Tech, also is represented by Clinch Valley College at Wise and the Mountain Empire Community College at Big Stone Gap. The coal industry is represented by Penn Virginia and its Penn Virginia Resources subsidiary, the Pittston Coal Co., and Contracting Enterprises. Citizen involvement includes Lenofwisco, the planning district composed of Lee, Scott and Wise counties and the city of Norton, and the Citizens for Better Reclamation.

"Everyone is working together for the benefit of the region," Slemp says.

Cattle Herd Successful
Gerken and fellow Extension specialist

Virginia Tech's (VPSU) Extension and research arms are major contributors to a cooperative reclamation project. Here, visitors examine erosion controlled slopes that are part of the Southwest Virginia Project.

A.L. "Ike" Eller Jr., an animal scientist, already have found one way that the land can be used—raising beef cattle. They have maintained a herd of beef cows on the property since June 1980 and have watched it produce three calf crops.

"Results indicate that the beef cow-calf herd can be adapted to the available forage on the strip-mined land and will produce at or near the levels expected elsewhere in Virginia," Gerken says.

The calf performance in the experiment has been excellent, Gerken said. Twenty-four calves in the first crop sold for an average price of $348 a head and had an average weight of 505 pounds. The second crop of 22 calves averaged $321 per head with an average weight of 585 pounds.

"There is no question in my mind that cattle can be raised on this land which are comparable in weight and quality to any which are produced in Virginia. The big question is whether the pastures can be maintained over the long haul," Gerken points out.

Soil Yields

Dan F. Amos, associate professor of agronomy, and W. Lee Daniels, a research associate, are conducting research with Gerald D. McCart, Extension agronomist in soil fertility, and James A. Burger, assistant professor of forestry, to find how soils in surface mined areas can produce optimum yields. The project looks at the effect of selected overburden materials on mine soil properties and plan growth. The U.S. Office of Surface Mining Reclamation and Enforcement recently gave the University a $50,000 grant to support this project.

In a mine spoil characterization and mapping project, Amos and Daniels assessed the plant nutrient potential of the reclamation area, characterized the major mine soils and produced a map showing the location of the major mine soil mapping units describing each.

After sampling, analyzing and mapping the soil of the three benches at the project, they found that the soil varies in pH from extremely acid to moderately alkaline. Soils were found to be shallow, and rocky; over half had been compacted during reclamation. Much of this soil is severely affected by dry weather.

Amos and Daniels, however, found that where mine soils had formed on predominantly sandy, uncompacted soils, there was vigorous plant growth and deep root proliferation.

Amos said, "This reinforces our belief that, with a little extra effort, surface mine operators could select and place overburden materials in a manner that would result in productive mine soil."

Turfgrass Tests

John R. Hall III, Extension turf agronomist, David C. Martins, professor of agronomy, and McCart are looking at the turfgrass species and soil additives that can provide the most functional turf for use on home lawns and recreational areas which use mine soil. They have used varieties of Kentucky bluegrass, tall fescue, fine fescue, perennial ryegrass, bermudagrass and zoysia grass in their research.

The researchers are looking at the use of sludge, sawdust and topsoil in various rates to find the better mixtures which produce good turfgrass. Their effect will be measured in relation to ground cover, turf quality, foliar analysis and rooting patterns.

Dale D. Wolf, an associate professor of agronomy, and a graduate student, Robert L. Williams, are studying sericea lespedeza management in connection with other forages. The pair is looking to see if there are ways that the legume can be controlled and yet used as a forage.

Plant Introduction

Charles R. O'Dell and Stephen C.

Cattle forage near the Powell River in Wise County, Virginia—a new production use for surface mined land discovered by research and Extension specialists.

Myers, Extension horticulturists, and Ronald D. Morse, associate professor of horticulture, planted 350 apple trees and, thus far, are pleased with the survival rate. The main problem has been excessive settling in some areas that caused rain water to stand in the plant hole and suffocate the roots.

The three also planted strawberries and blueberries. The strawberries appear to be adapting to environment. The blueberry project is long term as the bushes are not expected to begin bearing until 1984. There are also plans to plant grapes at a site adjacent to the orchard.

Their plantings of tomatoes, green beans and acorn squash have produced yields on limed plots which are comparable to Virginia state average commercial yields.

The three researchers feel that many vegetables can be successfully grown on mine soils that are treated with lime, fertilizer and some form of organic material. Black plastic mulch definitely increases productivity under normal rainfall conditions. Since mine soils are normally low in nitrogen, they feel research is needed to evaluate the best methods of meeting this requirement in a fast-growing plant species, such as squash.

Timber Research

Harold W. Wisdom, associate professor of forestry, and Terrence D. McCay, a graduate student, are evaluating the economic feasibility of harvesting timber on the land and estimating the impact of the forestry project.

There are a number of forest products industries in southwest Virginia, northeast Tennessee and southeast West Virginia. Potential markets, therefore, look promising.

The pair also is working on data of manufacturing costs for alternative wood products plants, together with harvesting and transportation costs, information on prices and sales potential for a discounted cash flow analysis.

Site factors are being examined on surface-mined land which affect the growth and survival of the seedlings. The project involves 10 species of hardwood and five pine species. So far the seedling survival rates have been excellent.

Robert H. Giles Jr., professor of fisheries and wildlife sciences, completed a comprehensive resource area plan. The data were used to select the best sites for residences, orchards, pastures and forests and for analyzing the potential of various sites.

Gerken observed that the volume of research being conducted at the site will give a "total package" of possible uses for the land. Although local studies would have to be done, the results from the Powell River Project should be applicable to many surface-mined areas in other parts of the region. □

Coming to Grips with the Mud Bowl

Robert D. Walker
Extension Natural Resources Specialist
and
Doug Peterson
Extension Communications Specialist
University of Illinois

A diverse group has gathered around a conference table to discuss whether soil erosion standards should be voluntary or mandatory.

"Listen," says one, "for the past 50 years since the 'Dirty Thirties,' soil conservation has been voluntary and little progress has been made. How do you expect a voluntary program to work?"

"You've got to give a voluntary program a chance," counters another. "Most farmers are sincerely interested in controlling erosion. They just need financial assistance to get the job done."

When a third person says that a mandatory program may be necessary if the voluntary approach doesn't work, the fellow next to him thumps the table and bursts, "Give me a break! You let the bureaucrats move in with their regulations and before you know it you'll have a bunch of people who've never even seen an acre of eroded land calling the shots!"

This scenario, which gives just a flavor of the controversies surrounding the erosion problem in the United States, was enacted in one of the University of Illinois Extension Service's new slide sets on the theme, "From Dust Bowl to Mud Bowl."

Saving the Soil

The slide set is part of a new "Land and Water" series of publications and slide programs that focus on the growing interest in soil conservation throughout Illinois and other parts of the country.

In turn, the Land and Water series is part of the Extension Service's aggressive participation in the Illinois erosion-control planning process and program.

To put this in the proper perspective, though, requires some background.

At a farm southwest of Tiskilwa, Illinois, active gully erosion stems from overstocking pasture.

Interest in soil conservation in Illinois developed out of the Dust Bowl era and continued into the forties and mid-fifties when most of the state's 98 soil and water conservation districts were established. However, technological advances increased crop yields at about 2 percent per year during this period. So many people in the agricultural community slowly slipped into what has been called "the invisible trap."

A symptom of the invisible trap is the tendency to say, "Who needs to worry about whether erosion is stealing away the most productive soils? Technology will come up with a way to keep yields high."

Section 208

In the early seventies, when environmental interest was at its peak, the United States passed the Water Pollution Control Act Amendment. Section 208 forced states to look again at water pollution problems, including those caused by soil erosion.

Most previous water pollution work had concentrated on "point" sources of pollution—pollution from easily identified sources such as pipes carrying industrial wastes. But Section 208 put the spotlight, for the first time, on non-point sources, such as runoff from agricultural land, construction sites, and urban development.

In 1976, the Illinois Environmental Protection Agency took the lead in developing a pollution-control plan for the major agricultural regions in Illinois. Other participants included farm organizations, commodity groups, fertilizer and chemical dealers, farmers, and many state and federal agencies—the Soil Conservation Service (SCS), the Agriculture Stabilization and Conservation Service (ASCS), the Department of Conservation (DOC), the Illinois Department of Agriculture (IDA), the Association of Soil and Water Conservation Districts (ASWCD), and the Cooperative Extension Service (CES).

Extension Takes Charge

The Extension Service was put in charge of educational outreach and was represented on the main work team—the Agricultural Task Force. Robert Walker, Extension natural resources specialist at the University of Illinois, served as secretary of the task force and chaired the subcommittee on soil erosion.

As the study of water pollution problems got underway in what became known as "the 208 planning process," the Cooperative Extension Service at the University of Illinois put its educational program into motion.

A newsletter, "208 Update for Agriculture," became the communication voice among 3,000 agricultural leaders in Illinois, state and federal agency employees, advisory groups, key state legislators, and environmental groups.

Left: This farm in Ford County, Illinois, typifies the messy problem of handling livestock wastes. Runoff from livestock feedlots is a major environmental problem to agriculture in the state. Below: A chisel plow leaves crop residue on a field. The switch from the moldboard plow to the chisel plow demonstrates the increasing interest in conservation tillage systems.

By keeping agricultural leaders on top of upcoming events, such as public hearings, public input was drawn into the planning process.

In addition, regular news releases were sent to all county Extension advisers for radio, newspaper and newsletter use. Other stories went directly to the 140 daily newspapers throughout the state; radio programs on the 208 process were sent to a 100-station network covering agricultural news; three 4-minute television programs went to 12 stations; and four 2-hour sessions were held over the university's telephone communications network.

The network, known as TELENET, reached 40 stations whose audiences consisted of Extension council members, soil and water conservation district board members, representatives from government agencies and farm organization leaders.

The 208 process generated volumes of material, but the Agricultural Task Force focused its attack on two major agriculturally related problems—soil erosion and runoff from livestock feedlots. Problems of pesticides and plant nutrients were considered part of the soil erosion problem because most of these chemicals reach waterways by traveling piggyback on moving soil.

Because the Illinois Pollution Control Board already had developed a program for bringing feedlot waste under control, the remaining question was what to do about controlling soil erosion.

How Severe?

A first step was to determine the severity of erosion on Illinois farmland. A study revealed that about 10 million, or 40 percent, of the state's 24 million acres of farmland suffered from erosion above the tolerance level. When erosion exceeds the tolerance level, or "T value," that means soil is being lost so fast that its natural productivity is also being lost.

The eventual product of the 208 planning process was the State Water Quality Management Plan—a plan which handed the job of managing the erosion-control program to the Illinois Department of Agriculture and the 98 soil and water conservation districts.

Again, the Extension Service was given the lead role in disseminating publicity and educational materials. The 208 newsletter was set aside after its 27th issue in 1981 and the next stage began.

"T By 2000"

Through 1981 and 1982, the Department of Agriculture and the 98 districts hammered out a series of erosion-control goals with the ultimate objective being "T by 2000." In other words, erosion on all farmland in the state must be brought within the tolerance level, or "T value," by the year 2000. Leading up to the "T by 2000" goal was a series of shorter range goals.

The erosion-control program went into effect on January 1, 1983, at which time the Illinois CES presented its Land and Water series. The series consists of six slide programs and six publications—all which have been reviewed by representatives from a variety of agencies.

This package of materials, being continually expanded, is designed for use by Extension and SCS staff. Materials reach high schools and junior colleges through the university's Vocational Agricultural Service.

Teach the Landowners

The Land and Water series aims to teach landowners the following:

- How Illinois has established goals for controlling erosion and how important it is to meet those goals.
- How to estimate soil erosion losses and the amount of soil saved with conservation practices.
- How to evaluate the economic impact of erosion.
- How the soil erosion process and the basic principles of erosion-control operate.
- How to evaluate the costs and benefits of specific soil conservation practices.

Left: Contour strip cropping–alternating row crops with strips of sod–is a technique many Illinois farmers are using to bring erosion under control. Below: Hillard Morris, chairman, Soil and Water Conservation District Board in Effingham County, Illinois, uses a truck and three bushels to illustrate erosion damage at an Extension Service field day.

- How to make the best use of technology and financial resources to plan and implement soil conservation programs.

The first publication and slide set, "From Dust Bowl to Mud Bowl," puts erosion in the historical context, beginning with the dust storms of the thirties and how they brought the problem into national view.

The second publication and slide set, "T by 2000," outlines the state erosion-control program and what it will take to bring the 10 million acres with excessive erosion into compliance by the year 2000.

"Raindrops and Bombs," the third program, expands on the often used but appropriate comparison of raindrops with bombs. During a rainfall, millions of drops fall at velocities reaching 30 feet per second, exploding against the ground and splashing soil as high as 3 feet in the air and as far as 5 feet from where they hit. The program analyzes such forms of erosion as sheet, rill, and gully erosion. Understanding the mechanics of the erosion process gives a clearer idea of how to control the erosive impact of rain and runoff water.

Many erosion forces are hard to see with the naked eye. For example, when a 1/8-inch layer of soil erodes from a field, a farmer probably would not notice it. But when a 1/8-inch layer erodes away, that means the field has suffered the loss of 20 tons of soil per acre during the year.

To deal with this problem, the fourth program, "How to Measure What's Missing," gives a step-by-step lesson on how to use the Universal Soil Loss Equation—which figures out the rate of erosion on a piece of land.

The alternative strategies for controlling erosion then become the subject of the fifth program, "A Plan For The Land." The landowner is instructed on how to evaluate the available conservation tools—terraces, grassed waterways, contour farming, conservation tillage, and crop rotations, for example—and how to piece them together into a plan that will adapt to this particular piece of land.

The sixth program, "What Price Conservation?", examines the complicated question of economics and soil conservation. After all, financial questions are at the core of the erosion problem. Often, landowners must farm their land intensively to meet mortgage payments and the family's other financial needs. Also, many farmers feel that, because the returns on soil conservation practices do not come for many years, they must put their capital into an enterprise that will give them a more rapid return.

Good Response

The Extension erosion-control materials received enthusiastic response at a series of soil conservation meetings in December 1982. The purpose of the meetings was to train various staff on how to publicize and educate the public about the state erosion-control program. Instead of telling state staff, "Here's what you have to do; so go out and do it," the staff was provided with tools to carry out the task—the Land and Water series.

So far, the major problem has been keeping up with the demand for the slide sets and publications. Requests have been coming from all of the groups represented at the winter training meetings—ASCS, SCS, soil and water conservation districts, and the Extension Service.

Meanwhile, back at the conference table . . .

"Hey, other industries have regulations!" says one agitated person. "Why should agriculture be exempt? Does ownership of land mean you have the right to spoil our resources for future generations?"

But another's response is, "You know, if mandatory erosion-control regulations were passed, there'd be such opposition that I bet the program would receive less cooperation than a voluntary approach."

"Not only that," adds the next person, "but it'd probably cost more to police mandatory standards than it would to make them voluntary and provide financial incentives."

Debates such as these in the late seventies eventually led to Illinois' decision that the erosion-control program should be voluntary, not mandatory. However, the key to any voluntary program is education—teaching farmers that a problem does exist and that there are ways it can be solved. That is when the Cooperative Extension Service steps into action. □

Cleaner Water Through Interagency Cooperation

Thomas R. Halbach
Community and Natural Resources Development Agent
CES, University of Minnesota
and
Gary Williams
Chief of Planning and Standards, Region V
Environmental Protection Agency
Chicago, Illinois

Couple concern for the environment with a strong education awareness program. Involve two government departments—not just in Washington, D.C., but out in the grassroots, the Midwest where the problem exists.

The result—establishment of a CES liaison position and a closer working relationship in the area of nonpoint source (NPS) water pollution control between the U.S. Environmental Protection Agency (EPA) Region V office in Chicago and six state Cooperative Extension Services.

History
Discussions within Extension on how to best work with EPA go back to 1972 and passage of PL 92-500, the Clean Water Act. In 1976, the 208 Nonpoint Water Quality Planning process stimulated additional discussions.

Region V staff felt that the Cooperative Extension system had a high degree of credibility, longer history and an excellent information delivery system. With this in mind, EPA staff, in 1978, established closer contact with the six states in Region V.

In January 1979, EPA and Extension Service, USDA, signed a memorandum of understanding to work together in the area of water quality. In August 1979, the National Extension/EPA Executive Committee drafted and approved an outline of "Cooperative Extension's Role in Water Quality Programs."

In March 1980, the state CES directors in Region V (Norman Brown, Minnesota; Gale VandeBerg, Wisconsin; Gordon Guyer, Michigan; William Oschwald, Illinois; Howard Diesslin, Indiana; and George Gist, Ohio) agreed to establish a CES liaison position.

During its first 6 years of existence, EPA Region V had found that controlling pollution from point sources alone would not always achieve water quality goals, especially in Lake Erie.

Position Established
The two agencies agreed in September 1980 to establish a CES liaison position in the EPA Chicago office with 50 percent funding from EPA and 50 percent from the Cooperative Extension Services in Region V.

In December 1980, Tom Halbach became the first CES liaison to EPA Region V, the first position of its kind in the Nation. The long-range goal was to get widespread application of water quality Best Management Practices (BMP's) where they are needed to achieve water quality goals. Primary objectives are:

- Produce a CES liaison newsletter discussing current EPA and CES water quality programs.
- Conduct monthly EPA staff seminars on various aspects of American agriculture, CES, USDA, and current AgNPS projects in Region V.
- Establish a formal system of CES water quality contact people.
- Route CES and EPA materials and publications for information purposes to selected staff.
- Arrange for CES staff, both county and state, to meet with EPA staff whenever possible.

Project Participation
Some of the more important EPA projects include:

- The Black Creek project, Indiana, the Nation's longest-running AgNPS project, began in 1972 and was completed in 1982. (The final report will be available shortly.) Black Creek showed that not all agricultural areas contribute equally to water pollution.
- The four Rural Clean Water Projects are demonstrating the USDA, EPA, state and local units of government can work together.
- The Model Implementation Project in six counties surrounding Indianapolis, Indiana.
- The NPS report developed under Section 208.
- The Great Lakes Tillage demonstration projects under Section 108.
- The state agricultural Water Quality Strategies were reviewed for Michigan, Wisconsin, Illinois, and Ohio.
- The U.S. Army Corps of Engineers' Lake Erie Waste Water Management Study.

Specific Accomplishments
The liaison position has had many positive accomplishments:

- A $40,000 EPA grant to incorporate water quality information in CES staff development programs during 1982 and 1983 to bring county agents up-to-date on current research findings related to water quality BMP's and their application.
- Additional EPA funding of $38,000 for the county agronomist position in Tuscola County, Michigan.
- Additional EPA funds of $25,000 to Michigan State University for analyses of conservation tillage systems in the Saginaw Bay project area.
- EPA funding of $8,000 to Ohio State University for revising fertilizer recommendations.

Future Challenges
Although a high level of interagency cooperation has been attained, several challenges remain. The continuation of regular personal interaction between EPA and Extension is essential, as is the continued exchange of information. Within USDA, the Cooperative Extension system, the Soil Conseration Service, and the Agricultural Stabilization and Conservation Service need increased funding and greater coordination to integrate water quality information into staff development programs. EPA also needs increased funding in the AgNPS area.

From a technical standpoint, AgNPS pollution needs to be reduced in many areas if water quality goals are to be achieved, a fact that needs to be communicated to the appropriate decisionmakers.

The final result will be cleaner water for all of us to enjoy. □

Bay Cleanup Boosts Economy

Jim Bottom
Editor-Writer
Oregon State University

Cow manure. Some 275,000 tons of it from 115 dairy farms. More than 100 inches of annual rainfall on 364,000 acres. A 6-mile-long bay used for shellfish harvesting, fishing, and recreation.

These are the things pollution nightmares are made of, says Jong Lee, a former Oregon State University seafood specialist in microbiology.

How a seafood specialist became involved in a major water pollution problem that threatened Oregon's oyster industry, public health, tourism, and the reputation of the state's coastal playground is seemingly strange. But it's no more odd than the unusual groups who were involved in solving a critical problem: reducing fecal coliform in Tillamook Bay.

The clean-up of Tillamook Bay is a story matched only in scripts made for television movies, says Jim Moore, an Oregon State agricultural engineering Extension specialist. "It's an excellent success story," he says.

Cooperative Program
Moore's participation in the cleanup campaign has been recent. The campaign has involved OSU Extension, OSU Sea Grant, the oyster and dairy industries, the Oregon Health Division, the Oregon Department of Environmental Quality (DEQ), The Oregon Department of Agriculture, the Oregon Department of Fish and Wildlife (ODFW), the Soil Conservation Service (SCS), and the Agricultural Stabilization and Conservation Service (ASCS)—just to name a few groups involved to date.

Moore, along with several colleagues, designed the successful computer model that's being used to tell farmers how to manage dairy herd wastes to keep harmful micro-organisms out of the bay.

"Basically our job was to develop the model to evaluate manure management practices," he says. "That's been done, it's currently being used and we're just tickled by its performance."

Lee, on the other hand, was an early participant in the cleanup effort—a researcher playing an informal Extension role. His involvement came about through his research in the microbiological quality of seafood for OSU Sea Grant. When the industry was threatened by pollution, oyster growers asked Sea Grant for help. Lee became a go-between for oyster growers, dairy producers and various state and federal agencies. His early research on the bay's water quality formed the nucleus of the current cleanup efforts.

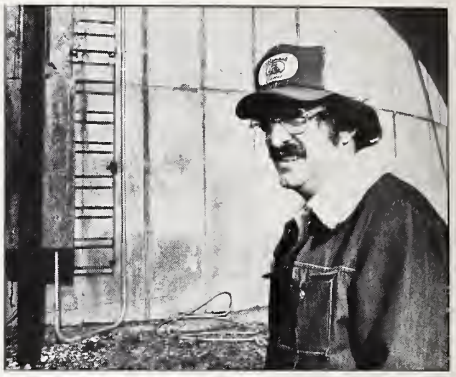
Lee now heads the newly founded Fishery Industrial Technology Center at the University of Alaska's Kodiak branch. He says dairies weren't the only polluters. Five sewage treatment plants also deposit treated sewage into Tillamook Bay. During heavy rains, these plants sometimes overflowed, dumping untreated sewage into the bay. Lee served on a task force that made recommendations to the Oregon State Health Division regarding this and other problems.

Oyster Industry
Oregon's oyster industry is small. It produces about one-tenth that of the State of Washington, or only about 24,000 gallons per year. But Tillamook Bay accounts for 65 percent of Oregon production. Historically, the federal Food and Drug Administration was critical of Oregon's shellfish sanitation program.

In 1977, the agency threatened to remove its federal endorsement of Oregon's shellfish. Without this endorsement, oyster growers could not ship across state lines.

"I was able to talk to dairymen and creamery people and show them that they can raise cattle elsewhere, but the bay is the only place oysters can be raised," Lee says.

Bob Pederson, Tillamook District SCS conservationist, gave technical advice to dairy owner Lewis Plantenga who built this 27,000 gallon manure storage tank on his Tillamook farm. The storage tank will allow the producer to keep manure from his 350 cows from entering Tillamook Bay.



But Lee says the problem was broader than that.

"It wasn't a matter of just saving the industry," he says. "It was a matter of saving Oregon's good name. If you prohibit harvesting oysters, then you also prohibit recreational clamming and fishing. That impacts tourism and other things Oregon is known for."

Dairy Industry
Almost 120 dairy farms are found in the lower tidal areas. Forty-one of those farms are located next to the bay itself. About one-half of them are built on clay soils that saturate quickly and cause runoff, which then washes animal waste into the bay. When Lee's task force identified these farms, Tillamook County Extension agent John Massie went to work.

"We went after a $2 million grant available from the Rural Clean Water Act to assist dairy producers in remedying some of the problems," says Massie.

In June 1981, the Rural Clean Water Project (RCWP) was approved for Tillamook Bay by Secretary of Agriculture John R. Block. Since then, about 90 applications have been received for the money to be used for waste storage facilities, says Massie. About 40 were listed to receive these funds initially. When the first grant was

Top center: Bruce Thomas (left), a local dairy owner, and Bob Pederson, soil conservationist, worked together to improve manure handling procedures and facilities on Thomas's Tillamook dairy. A $27,000 Rural Clean Water Act grant helped to build storage facilities that keep waste from Thomas's 100 dairy cattle from entering this small creek which feeds into Tillamook Bay.

Top right and above: Tillamook Bay oyster worker finds another likely bivalve candidate for his basket, then hands his partial harvest to a co-worker. Approximately 65 percent of Oregon's oyster production is taken from this bay. This production was threatened by a major water pollution problem until a cleanup campaign–the result of a vast cooperative effort lead by Extension–saved the industry.

committed, Massie and others went after another $1.2 million. About $300,000 has been received so far. The money has done a lot toward improving Tillamook Bay's water quality.

"You can't see the improved quality of the water itself, but you don't see manure running from an uncovered pile into a stream," County agent Massie says. "You won't see that any place now."

Success Story

The Tillamook Bay success story goes beyond the improvement of water quality, says Bob Pederson, Tillamook district SCS conservationist. As a result of local construction contracts, employment is up, he says.

He explains that dairy farmers are more than matching the government grants, taking the opportunity to upgrade facilities beyond what is recommended.

"To make these improvements work, they're doing other things," says Pederson. "They're adding more than double the money they're getting from the grants."

And this has helped employment, he says.

"At the start of the project, Tillamook County was number three in unemployment and there was hardly any construction going on," says Pederson. "It's put people to work."

Pederson says local contractors are doing most of the work, which includes concrete holding structures, roof-building and gutter work. By using a computer model developed by the Extension specialist, the SCS conservationist predicts that the first $1.8 million of committed Rural Clean Water Act funds will generate more than $5 million for Tillamook County.□

Florida Water: Ag-Urban Common Cause

Mary Laurent
Extension Communications Specialist
Institute of Food and Agricultural Sciences
University of Florida

Above: Sludge from an anaerobic lagoon is removed for land-spreading; wastewater in this site from a dairy operation has been biologically treated. Florida Cooperative Extension Service specialists have begun a statewide program with clean water (left) as the "ag-urban common cause."

Florida's water resources are the state's greatest assets—its most pressing legislative responsibility and ultimately, the limiting factor for continued growth.

Despite a population that grows at a rate of 7,000 new residents a week, agriculture is still the top user of water in Florida. As the state's largest industry, agricultural operations occupy the most land and discharge the most drainage into the state's 1,700 streams and rivers and 7,700 lakes.

Under the banner "Producing Good Food While Protecting Florida's Water," the Florida Cooperative Extension Service has begun a statewide program promoting clean water as the ag-urban common cause.

Water Program Background

"In Florida we have a rapidly growing population and a diverse, dynamic agricultural industry. The two are bound to come into contact. What we need is constructive interaction, not obstructive confrontation," says L. B. Baldwin, coordinator of the water program. Baldwin says that the program has a twofold objective: "To teach cost-effective pollution control practices to producers and to let the public know agriculture is doing something to protect the water it uses."

The Florida Department of Environmental Regulation funded the program in 1981. A study found that more than half the pollution in the state's lakes, streams and rivers came from indirect, or *nonpoint* sources drainage and runoff from forests, mines, city streets and farmlands—rather than from direct discharges of factories and sewage treatment facilities.

Best Management Practices
PRODUCING GOOD FOOD WHILE PROTECTING FLORIDA'S WATER

Slogan of the Florida Agricultural Water Quality Program.

The program began with a random and representative mail survey of 2,000 Floridans in December 1981. The survey measured attitudes and knowledge of water quality issues. Its most impressive finding was that an overwhelming number of the state's residents felt that water pollution was seriously threatening the environment and almost as many had personally experienced a water quality problem in their county.

Awareness Campaign

In March 1981, the Florida Cooperative Extension Service sponsored a conference on the technology to combat agricultural nonpoint pollution. It attracted an interested and responsive audience of scientists, water managers, soil conservationists, members of regulatory agencies, and representatives of state agricultural interests.

An 11-minute slide-tape—the next project—discussed the nature and prevention of pollution from nonpoint sources like agriculture and described the state's voluntary approach to water protection. A special version of the slide-tape was created for supervisors of the state's 61 Soil and Water Conservation Districts, the agencies responsible for implementing conservation programs on the local level.

Other materials developed include news and feature releases to newspapers, magazines and broadcast stations, public service announcements, a travelling display, general information leaflets and several technical fact sheets and guides.

Dairy Producers Clean Up Their Act

Mary Laurent
Extension Communications Specialist
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University of Florida

Dairy cows cool off in the shade instead of a stream. The portable shade structure also prevents waste accumulation.

Nowhere in Florida is clean water a greater priority than in the Lake Okeechobee region. This vast inland lake supplies fresh water to five lakeside communities.

Canals route the lake's water south and east, to serve as the reserve for the entire east coast of the state. Floridians fear the lake is dying due to an overload of organic pollutants. They are anxiously watching the clean-up efforts supported by several state, federal, and local agencies, including the Florida Cooperative Extension Service.

Some pollution comes from dairy and cattle operations in the 118,000-acre Taylor Creek-Nubbin Slough watershed, says Wilmar Schultz, Okeechobee County Extension director. "The pollution in this area is primarily from agricultural runoff, from animal waste that flows into streams or is directly deposited by the cattle as they wade in the streams."

Program Response
Assisted by federal funds from the Rural Clean Water Program, Schultz is encouraging dairy farms in the project area to install pollution abatement measures. Response has been encouraging.

"Most farmers want to be good conservationists," says Kent Bowen of McArthur Farms, one of the first operations to participate. "The thing that has held us back in the past has been not knowing what to do."

A fishing enthusiast or duckhunter traveling south to Lake Okeechobee via the dairylands might now notice subtle changes brought about since the program began in January 1982. Cows are fenced away from streams and the wetlands where they once lounged on hot days. Instead, they are found resting under man-made shade structures, venturing into nearby water troughs when thirsty.

Other anti-pollution measures recommended to the dairy producers include:

- Constructing dikes and detention ponds to slow runoff rates,
- Growing filter strips of grass between pasture land and streams,
- Reusing treated wastewater to flush milking parlors and to irrigate pasture and cropland, and
- Biologically treating wastewater with carefully managed anaerobic lagoon systems.

Success
As preliminary data trickles in, it appears that the quality of water in the watershed has begun to improve. Significant decreases of nutrient levels in streams draining from dairy areas have been noted. Investigators credit the on-farm management practices recommended by the Extension Service as responsible for the cleaner water. □

Federal Projects
The program also lends support to two federally funded projects in Florida. The Taylor Creek-Nubbin Slough Rural Clean Water Project is aimed at sharply reducing the amount of nutrients in agricultural drainage flowing into Lake Okeechobee. Extension Service works with dairy farmers in the project area to encourage the adoption of management practices that keep the nutrients on the land for better grain and forage production. Already, a significant improvement in streams in the project area has been noted.

Another area of concentration is the Florida Panhandle, where much of the topsoil is eroding at a rate faster than it can be renewed by natural processes. Here, educational efforts focus on farming practices that stop erosion and associated sedimentation of surface waters. Through field days, an equipment loan program, and "how-to" publications, Extension Service is encouraging farmers in the Panhandle to adopt minimum (conservation) tillage, which has been shown to maintain or increase yields while decreasing erosion by as much as two-thirds.

Accomplishments
One of the major accomplishments of the Florida Agricultural Water Quality Program is the degree of cooperation it has achieved among federal, state and local agencies. These include the Soil Conservation Service, the Agricultural Stabilization and Conservation Service, state Soil and Water Conservation Districts, state water management districts, and the state Department of Environmental Regulation, which provided $86,000 of funding for the 18-month program.

Noting that funds for water quality have dried up during recent years, program coordinator Baldwin says, "We all want clean water and it makes sense to work together to make the most of what we have." □

Can Lo-Till Fill The Bill?

Dan M. Crummett
Extension Information Specialist
Oklahoma State University

Lo-Till, an educational/research program, has become synonymous with minimum tillage in Oklahoma. Here, a wheat drill works its way through last season's stubble.

Oklahoma's 2-year-old Lo-Till Program was germinated by the uncertainty of rising fuel costs, nurtured by a grassroots demand for knowledge, and, now, promises a harvest of answers for the future. Oklahoma wheat growers are looking seriously at chemical weed control in continuous wheat.

Oklahoma wheat farmers were among the first to feel the effects of rocketing fuel costs of the midseventies as they made numerous passes over their fields to control weeds, apply fertilizers and conserve moisture. Then, with the sluggish overseas market for their product, they became even more conscious of inputs as they faced a price squeeze and low commodity prices by the end of the decade. That feeling of helplessness led the producer-oriented Oklahoma Wheat Commission (OWC) to begin searching for answers.

"We have always been involved in wheat production research," says Mike Kubicek, OWC director, ". . . but with the economic squeeze tightening, we realized we needed to address the reduction of costs in producing our yields."

Funds for Research

Those needs were "addressed" with $175,000 of commission money to Oklahoma State University's Division of Agriculture for Research and Extension in late 1980, reports Wendell Bowers, leader of OSU's Extension Agriculture Program.

"For about 5 years, our Program Planning Advisory Committees had been stressing the need for work in minimum tillage," Bowers explains. "We already had some herbicide screening underway in the northwestern part of the state under the guidance of area agronomist Dale Fain. And, our weed specialists in research and Extension had interests in minimum tillage."

With the promise of the funding, OSU leaders and specialists in agronomy, ag engineering, ag economics, plant pathology and entomology, created an internal package to address the problems of the Oklahoma grower.

"Out of this came the term and logo, 'Lo-Till,'" says Jim Stiegler, Extension agronomist and Lo-Till project chairman.

"There has been lots of minimum tillage work done in the northern Great Plains, but their problems and ours are different," Stiegler explains. "Many growers in the north have an 11-month fallow, in which they can use long-residual herbicides. We, however, have to plant again in only 3 months, so long-lasting weed killers cannot be used."

Research done in the Texas Panhandle and western Kansas often does not address the needs of Oklahoma's producers, he says.

"We needed information," Stiegler says, "on how much, if any, moisture conservation we get from not using plows and disks. We needed to know the effect of residue management—and how much stubble is needed to protect the soil through our hot, windy summers. The effects of disease and insects on continuous wheat needed to be explored, along with what kinds of equipment would be required in minimum-till wheat."

"Those first OWC dollars were placed into a single account at OSU to be drawn upon by the multi-disciplinary force of specialists," Bowers explains. "We budgeted $100,000 for research and $75,000 for Extension."

"The response to the project among OSU personnel was phenomenal. The separate account allowed our people to work on the project without jeopardizing their other commitments."

Early Demonstrations

First-year successes included two public planting demonstrations in stubble (attended by at least 500 growers each), work on new spraying techniques and equipment, innovations in planter design and some surprises after the fall-drought of 1982.

"On our Lo-Till demonstration plots, we had wheat 4 inches tall late in '82, while nearby fields in conventional tillage were barely out of the ground," Stiegler says. "We apparently saved enough moisture for germination and a stand. That will make a real difference to the many growers who also run stocker cattle."

In addition to the dust and mud of demonstration plots, the hours working with more than 50 active cooperators, and the testing of new equip-

Interest is growing rapidly in the Lo-Till concept. Nearly 500 producers attended this Extension Lo-Till planter demonstration near Enid, Oklahoma, last summer.

ment aimed at Lo-Till concepts, the specialists collaborated on a Lo-Till brochure, detailing the concepts, potentials and overall methods of minimum tillage in Oklahoma wheat fields.

Introducing the Program

The Division's Agricultural Information Department followed the progress of the program—supporting the research and education functions with news releases, publication of the 16-page "Lo-Till Farming" overview, and production of a video tape report and a Lo-Till slide-tape set used for introducing growers, lenders and educators to Oklahoma's brand of minimum tillage.

But what about the wheat farmer—ultimate consumer of Lo-Till gospel?

"There's a lot of interest, and a lot of skepticism," says Stiegler.

"Wheat producers historically are not in the chemical application mode. Many find it difficult to justify the expense of chemicals, but they are still interested in the research findings," he points out.

"Right now tillage and labor can beat the cost of chemicals," Stiegler says. "But what about the future? What if diesel fuel jumps to $3 a gallon?"

"Just since we began with Lo-Till, we've come up with new rates for herbicide application which have helped bring down the high initial cost of these chemicals. Also, there are other things to consider."

These matters involve soil conservation, moisture retention, reduced wear on machinery, smaller machinery requirements, less labor and improved timing for harvests.

No Magic Solutions

OSU's specialists have no illusions of producing a magical solution to all the ills of producing wheat. They are the first to admit Lo-Till won't come up with all the answers.

"I'd be crazy to predict any certain number of producers using Lo-Till by any certain date," says Stiegler. "Outside influences will determine the use of what we're finding."

"But, what we're learning, we need to know. With decreased water supplies and increased fuel costs forecast in the next decade or so, what we learn now will be vital to our surivival as a wheat-producing area. With Lo-Till, we'll have that knowledge," Stiegler says. □

North Carolina—Focal Point For Water Quality Projects

Richard P. Maas
Jonathan M. Kreglow
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Extension Specialists, Water Quality, and
Frank J. Humenik, Project Director, Extension
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National Water Quality Evaluation Project
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Water pollution from point sources (such as industry and sewage treatment plans) was greatly reduced during the seventies. Since then, nonpoint sources (such as cropland, construction sites, roadbanks, and mining) have been found to be greater sources of water pollution than was previously believed. Of these sources, agricultural activities cover the most land area. In fact, agriculture has been estimated to be the largest source of pollutants in nearly two-thirds of U.S. watersheds.

Rural Clean Water Program
Over the years, many conservation practices have been developed to protect agricultural land and minimize water quality impacts. These are now called Best Management Practices or BMP's. The Rural Clean Water Program (RCWP) mandated by the Congress was initiated in 1980 by the U.S. Department of Agriculture (USDA) and the Environmental Protection Agency (EPA) to demonstrate water quality benefits from using these BMP's.

Early in the RCWP program, staff saw that individual projects might require assistance in emphasizing the water quality dimension of this agriculturally based project. Further, a national evaluation of agricultural nonpoint source control projects was deemed necessary to determine the state of the art and to document methods and technology leading to water quality improvements. For these reasons, the National Water Quality Evaluation Project was formed under a cooperative agreement by USDA/EPA with the Biological and Agricultural Engineering Department at North Carolina State University.

The project staff for this Extension project consists of four specialists with a combination of water quality and agricultural engineering expertise, a full-time staffer detailed from the Soil Conservation Service, and input from a resource economist with USDA's Economic Research Service (ERS). Direction of this Extension assistance and evaluation of RCWP and other agricultural nonpoint source control activities is determined by a federal project advisory committee composed of representatives from SCS, ASCS, CES, USDA's Forest Service, ERS, and EPA.

Cleaning Lake Tholocco
The Lake Tholocco project in Alabama demonstrates the kind of help the North Carolina Extension Service state project can provide to the 21 individual RCWP projects scattered across the country. Lake Tholocco, located near Ozark, Alabama, serves as a primary fishing and boating resource. In recent years, the beaches have been closed often because of excessive fecal coliform bacteria levels. Sediment has also been filling in large parts of the lake, making these areas too shallow for boating and water skiing. The bacteria contamination has been traced to improperly managed animal production facilities and the sediment to eroding cropland. Local goals are to slow sediment filling of the lake and to reduce bacterial levels to allow full use of this swimming and boating resource.

Many Groups Cooperate
Benefits of the cooperative approach under the RCWP program are already being seen. A cost-share program has been established to encourage all farmers to implement BMP's to control erosion and decrease sediment. All animal production units in the project area have been surveyed to determine ways to reduce bacterial contamination. Locally, effort made to gain farmers' cooperation, design water quality farm plans, get BMP's on the ground, and monitor water quality improvements has been a cooperative venture among USDA's Soil Conservation Service (SCS), Agricultural Stabilization and Conservation Service (ASCS), Extension, the state water quality agency, and the U.S. Army. The Army is involved because most of the lake lies within the Fort Rucker Army Base and the Army is responsible for water quality analyses.

Problems Draw North Carolina Aid
Cooperation and enthusiasm in the project area have been excellent from the start and progress has been rapid. Difficult problems have arisen, and the North Carolina project has been able to provide useful experience to draw from. For example, Army personnel had little experience or equipment for analyzing water samples. The project staff at North Carolina State University made suggestions and assisted in performing laboratory tests. Project participants now believe that recent analyses of water from the lake reflect progress being made.

The North Carolina State project staff also helped to measure sediment reductions to the lake within the project's limited monitoring budget. People were confident that sediment was being reduced because farmers were cooperating in installing practices to control erosion. However, it was important to measure reduced sedimentation rates in the lake. Once again, Extension specialists and local residents developed inexpensive solutions to difficult problems.

Finally, the analysis and interpretation of data from a study as large as the Lake Tholocco project are time consuming and involve specialized tasks. For instance, the amount of sediment and bacteria washed into the lake depends on the amount, intensity, and timing of rainfall. The first 2 years of the Lake Tholocco project were drier than normal. Last year, rainfall was above normal. Thus, higher bacterial levels were observed, although many of the management practices to control runoff from animal production-waste management systems had been installed. Data from the Lake Tholocco project were sent to the North Carolina State project staff for computer analysis, to assist with the management and evaluation of the rapidly developing data base.

Extension at North Carolina State University (NCSU) is engaged in a national evaluation of agricultural nonpoint source control projects. Whether working with Alabama personnel on fecal coliform analysis or reviewing a Rural Clean Water Program (RCWP) project water quality plan NCSU Extension specialists provide valuable assistance in documenting methods and technology leading to water quality improvements.

Techniques to normalize rainfall variations showed that reduced amounts of bacteria were actually being washed into the lake, given the excessive rainfall during the last year. Thus, the North Carolina State project staff complemented the excellent efforts of local workers to identify needs, develop alternative or more effective methodologies, and analyze data. The end result was that water quality is improving in Lake Tholocco.

Other North Carolina Activities

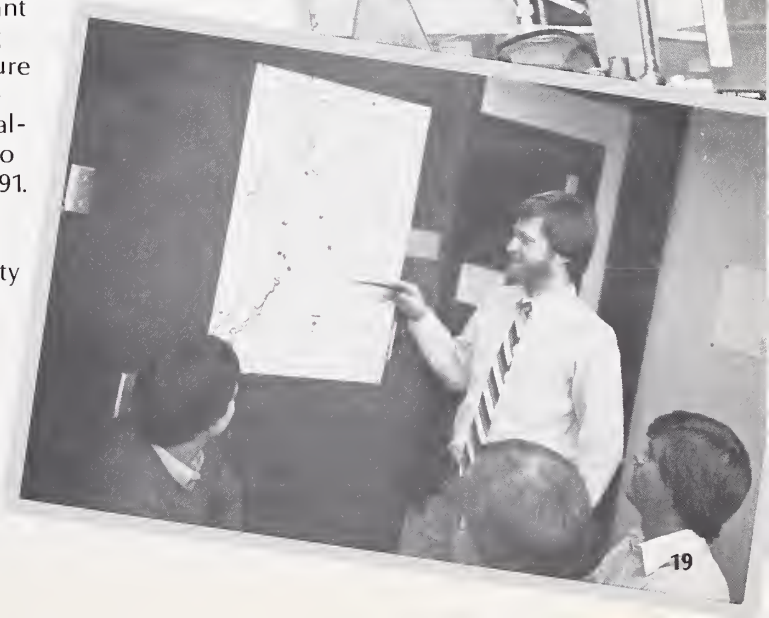
Another primary activity of the North Carolina State project has been to develop and publish documents to assist field personnel. Among these is "A Conceptual Framework for Assessing Agricultural Nonpoint Projects" which describes important steps in planning, designing, and implementing water quality projects. State-of-the-art reviews of BMP's for the control of sediment fertilizer and animal waste have also been published.

Another important activity of the North Carolina State project is to provide USDA and EPA headquarters with technical feedback on the progress of RCWP projects. The result is that technical problems encountered in the field are addressed and continuous direction can be given for achieving water quality goals.

Water Quality Effort

Over the years, a large amount of work has been conducted on small plots and fields to determine the effectiveness of practices to control losses or runoff transport of sediment, fertilizer, and animal waste constituents. While much has been learned, no documentation of the effectiveness of BMP's systems currently being recommended to solve water quality problems is readily available or commonly agreed on. The RCWP program was initiated as the first large-scale agricultural program with demonstration of water quality benefits as its foremost goal.

The 21 RCWP projects each cover land areas of 40,000 to 400,000 acres, so these projects represent one of the most complex water quality experiments ever conducted. North Carolina's project Extension specialists welcome the opportunity to provide future direction for the difficult but important challenge of making production agriculture more efficient while improving water quality. The program is to continue through 1991. Answers gained on production agriculture and water quality benefits of BMP's are likely to help to set agriculture policy for the 21st century. □



Extension's Role in STEEP

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A dramatic change is just beginning in American agriculture. This change will involve a revolution in the area of information management.

Past changes have seen the farm growing larger with capital, energy, and management inputs increasing as a substitute for labor. These changes greatly improved farm productivity. The next step will be to dramatically improve the efficient use of these extremely expensive inputs—capital, energy, and management.

Greater precision in quantitative assessment of the optimum levels for each of the various inputs will improve efficiency. But improving the precision of management will require the use of large amounts of information on resource management along with information on the biophysics and biochemistry of the green plant. We must study the system which converts solar energy into a usable form—food. Farmers may use microcomputers to process information, but will need programs and input data from sources such as the Cooperative Extension Service.

A Tri-State Program
Cooperative Extension in Washington, Idaho, and Oregon are working together to develop a tri-state Extension program. The purpose of this new program is to disseminate research findings associated with STEEP (Solutions to Environmental and Economic Problems).

STEEP is a multidisciplinary research program to develop new strategies and refine existing techniques to control soil erosion on croplands in the Northwest.

Among the soil erosion problems in the Pacific Northwest are wind erosion on sandy soils and erosion caused by irrigation. However, the greatest problem is in the dryland wheat-producing areas of Washington, Oregon, and Idaho, where water erosion is threatening future agricultural productivity.

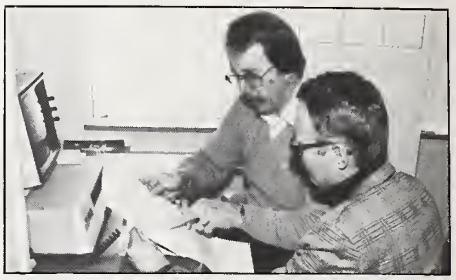
For many years the Soil Conservation Service (SCS) has considered the Pacific Northwest to be one of the most serious soil erosion areas in the United States. In Whitman County, Washington, for every bushel of wheat produced, an estimated 0.7 ton of soil is lost to erosion. The factors which cause the high rate of erosion and runoff include warm rains falling on snow-covered, frozen soil; unusually steep slopes; highly erodible silt loam soils; and a prevalence of winter wheat production using conventional tillage management.

Clearly, solutions to these problems will be relatively complex, and involve the inputs from many scientific disciplines working in close cooperation. It will take the efforts of biological, sociological, engineering, and earth scientists to develop recommendations to counter these severe erosion losses.

STEEP Research Program
In 1972, the wheat commissions from Idaho, Oregon and Washington, with the support of the agricultural experiment stations in the 3 states, the USDA-Agricultural Research Service (ARS), and federal, state, and local conservation and environmental agencies, prepared and submitted a tri-state research proposal. Funding for this program, which became known as STEEP, was approved and research initiated in 1976.

Several approaches have been used to develop improved methods of erosion control, but most in some way emphasize the development of no-tillage and reduced-tillage technology.

STEEP Funding
Since 1976, funds for STEEP research have been made available each year since 1976 by a special USDA Cooperative State Research Service (CSRS) grant to Washington State University, Oregon State University, and University of Idaho. Appropriations are also given to ARS in the three states.



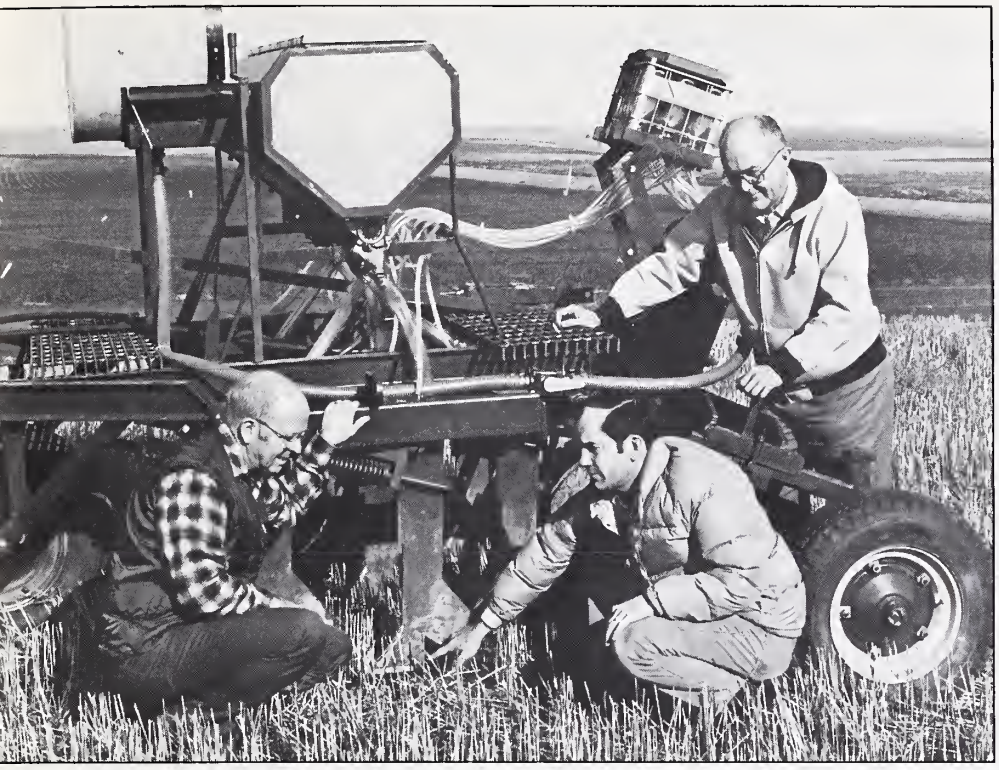
Herb Hinman (left), agricultural economist, Washington State University, explains the results of a computer program developed for STEEP to David Ruark, chairman of the research committee of the Washington Association of Wheat Growers.

Researchers and administrators from each state have served on a committee to coordinate the STEEP research program. Recently, the committee has been expanded to include representatives from Cooperative Extension Service and SCS.

Research Priorities
Experiment station scientists prepare research proposals to be considered for funding. Priority of projects is assigned on the basis of relevance to objectives, duplication of effort, balance among the objectives, and probability of success. This procedure has resulted in some 35 state scientists from 10 disciplines gaining financial support for 30 individual projects. Most of the projects have involved collaboration across disciplines, and in many cases, across state boundaries.

ARS appropriated funds are directed to research within the major objectives. STEEP has served to direct the research efforts of about 20 federal scientists.

Annual STEEP Review
Scientists and their administrators meet annually to discuss research results and review research needs.



Darrell Maxwell (left), area Extension agronomist, Oregon State University, learns about the interesting features of a no-till, shoe-type drill opener from Dale Wilkins (center), agricultural engineer, ARS, as Robert Ramig, soil scientist, ARS, looks on.

John Hammell (left), soil physicist, University of Idaho, and Rod Tittemore, scientific aide, measure soil moisture with a neutron probe. Robert McDole, Extension soil specialist, (Idaho), and Harry Riehle (center), SCS area agronomist, examine sediment. Edwin Dowding (right), engineer, (Idaho), explains the operation of a runoff collection device to Stephen Reinertsen, Extension associate, conservation tillage, (Idaho).

Representatives of the wheat-producer organizations, Cooperative Extension, and federal, state and local conservation and environmental agencies also attend these meetings to have input and to help set guidelines for future research. This STEEP review takes place prior to the allocation of the ensuing year's funding.

New Extension Program

In August 1982, special appropriated federal Extension funds were used by Oregon State University, Washington State University and University of Idaho to establish a STEEP Extension program. These funds, a one-time grant, were used to establish two Extension positions with sole responsibility to disseminate STEEP research findings. The audience for this program consists of farmers, county Extension agents, SCS personnel, conservation district supervisors, bankers, and others in the agricultural industry.

In addition to the federal Extension funds, the SCS in Oregon contributed funds to the program and each of the three states added special funds from a federal grant under Section 208 of the Federal Water Pollution Control Act Amendments of 1972.

A major objective of the Extension program for the first year is to compile and publish STEEP information in the form of state and regional Extension publications. In addition, a bimonthly newsletter is being distributed which describes newly available Extension publications and discusses goals and accomplishments of ongoing research projects. Radio and television will also be used to disseminate STEEP research findings. Slide-tape sets concerning conservation tillage will be made available to county agents and SCS personnel for use in educational programs.

Another function of the STEEP Extension program is to act as a liaison with researchers to encourage more multidisciplinary interactions. In addition, STEEP Extension personnel can help guide future research by encouraging feedback of farmer needs.

Future Plans

In the second year, it is hoped that the program be expanded to include large scale demonstration plots. An advisory board, composed of researchers from the different disciplines, will help design and manage the plots. This will require a systems approach to demonstrate strategies and techniques that have been developed in the STEEP program. The first step in developing comprehensive management packages is an evaluation of the systems approach. These management packages are the ultimate goal of the STEEP research program.

Even though STEEP is multidisciplinary, the tendency of researchers to work within their areas of specialty results in findings that need to be integrated into management packages. To accomplish this, innovative farmers, Extension agents, SCS personnel, and conservation districts are eager to cooperate with the STEEP Extension program. □

STEEP and Control of Soil Erosion

Robert Rost
Extension Information Representative
Oregon State University

Each year more than 110 million tons of topsoil erode from the dryland wheat country of the Pacific Northwest, an area of 90,625 square miles, or about the size of the state of Vermont.

Thirty million tons of this soil finds its way to streams, rivers, and coastal harbors where it silts up navigable channels making constant dredging necessary.

A significant amount of it accumulates in reservoirs behind dams in the Northwest thus shortening the life of hydroelectric generating facilities.

It's readily apparent that the erosion problem is more than just agriculture's alone.

Serious Soil Loss
The grain regions of eastern Oregon, central and eastern Washington, and western Idaho produce over a billion dollars' worth of small grains annually. Unless wind and water erosion can be brought under control here, this yearly loss of topsoil will have a serious impact on the economy of the Northwest.

A problem of this magnitude requires a solution of equally grand dimensions. That solution is STEEP. STEEP is "Solutions To Economic and Environmental Problems." It is a multidisciplinary research/Extension program designed to develop new strategies and refine existing techniques to control soil erosion on Pacific Northwest cropland.

"Finding a program that would give us answers on how to control erosion began 10 years before funding for STEEP was first approved in 1976," says Stanley Christensen, an Oregon farmer who has served eight years as president of Oregon's Association of Soil Conservation Districts.

"The effort put forth by local wheat leagues, wheat commissions, and state associations of soil conservation districts in Idaho, Oregon, and Washington led to the establishment of the program," he points out. "These groups recognized that solutions to erosion could best be found through interagency cooperation and support from the federal level."

Wide Range of Specialties
The STEEP effort requires the talents of plant geneticists, plant physiologists and plant pathologists; crop management specialists; soil physicists; soil chemists and soil microbiologists; micro-meteorologists; tillage engineers; cereal chemists; agricultural economists; entomologists; hydrologists and weed ecologists. These scientists are employed by the USDA Agricultural Research Service and the agricultural experiment stations of the three Northwest states.

According to Darrell Maxwell, Oregon State University area Extension agronomist for STEEP, there is no soil erosion control program quite like STEEP in the United States. "There may be programs patterned after STEEP in the future," he says, "but right now STEEP is the only program of its kind in the country—a new way of interagency teams working together to achieve research goals."

Funds for STEEP research have been provided annually since 1976 by a special USDA grant to Washington State University, Oregon State University, and the University of Idaho, and the Agricultural Research Services in the three states.

Norman Goetze, OSU Extension associate director and a longtime supporter of the STEEP effort, claims that that this approach is a unique problem-solving process because it keeps in mind that the changes and adoption in practices must suit a particular location.

At present, considerable attention is being given to funding and organizing the Extension effort to deliver the research results to the farmers who will put it into practice.

Stephen Reinertsen, Extension associate, conservation tillage, University of Idaho, and Darrell Maxwell, OSU area Extension agronomist (STEEP), have the responsibility to disseminate the findings of STEEP research to farmers who need it.

Maxwell is assigned to eight Oregon counties and two Washington counties. He firmly believes that delivery of STEEP information should employ the traditional Extension method of one-to-one contact where possible.

Symposium for Wheat Farmers
Information delivery tools that Maxwell is using include meetings such as a conservation tillage symposium recently held in Oregon for Northwest wheat farmers. These meetings give farmers the opportunity to get together so they can share new ideas that they have tried in the field, Maxwell points out.

Extension agents and SCS staff are constantly updated on the latest STEEP results at area Agricultural Research Centers.

Farmers: Prime Audience
"Of course, the farmer is the prime audience in the STEEP program," Maxwell says. "How farmers feel about STEEP is very important. Our method of delivery is closely associated with the Extension Service concept—helping people help themselves."

Jon Justeson, Sherman County Oregon farmer says, "New ideas in farming are a way of life. For years I've conserved soil by going to annual cropping to use the soil moisture every year. In dry years I summer fallow. I need whatever research information STEEP can provide."

Such comments are proof that STEEP information is vital in keeping the Pacific Northwest one of the top dryland producing regions in the world. □

Camping for Conservation

Dennis L. Elliott
Extension 4-H Specialist, Camping
The Ohio State University

The Ohio 4-H Conservation Camp has a long and impressive history. Annually, for nearly half a century, this program has taught youth to appreciate natural resources and acquire conservation skills.

Outstanding older 4-H members (two from each county) participate in the week-long program at the state 4-H camp (The 47th Ohio 4-H Conservation Camp was held in July 1982 at Camp Ohio near Utica, OH). The five subject matter areas are taught by faculty of the Ohio State University.

The 4-H members are challenged to become a vital part in the conservation of our natural resources by returning to their clubs, communities and counties and sharing what they have learned. They conduct programs for their local 4-H clubs, their donors, and at county 4-H events such as the camps.

Areas of Study
Campers develop an understanding of and appreciation for our natural resources. The interdependence of our natural resources is emphasized. The five subject matter areas are: land and its use; water resources; forestry; wildlife; and recreational land use.

The campers spend 90 minutes of intensive study in each of the five areas. The lessons are put to test as they apply what they have learned in the development of land use plans.

Walking Tour
All campers take a walking tour of the south farm which is located adjacent to the camp. In working units of four campers they begin developing land use plans for the 120-acre farm. Each work group is provided a large planning map on which to develop their plan.

Each camper's packet has a soil survey map of the farm, a small planning map and a soil survey map legend and soil interpretation. Utilizing these resources and their newly acquired knowledge, each work group develops a land use plan for the farm. They are very careful to observe the limitations and capabilities of the farm because at the end of the camp they must present and defend their plan to a group of their peers. These presentations are one of the many highlights of the week.

This program has been supported by the Federal Cartridge Corporation, the Ohio Federation of Soil and Water Conservation Districts, the Ohio 4-H Foundation and Bob Evans Farms, Inc. It has grown and developed over the past 47 years, and continues to serve this important area of 4-H education. □

For nearly a half century, the Ohio 4-H Conservation Camp has enabled state youth to gain a new understanding of our natural resources. Here 4-H'ers pick up pointers on everything from water sources to soil evaluation.

Nebraska Producers Break Tradition

Elbert C. Dickey
Extension Agricultural Engineer
University of Nebraska, Lincoln

Through Extension educational program efforts, row crop producers in Nebraska are gradually "breaking tradition" and adopting conservation tillage methods to reduce soil erosion.

During 1980 and 1981, Extension specialists presented educational information on conservation tillage and erosion control to more than 5,000 people at approximately 50 meetings throughout eastern Nebraska. In addition, Extension agents provided leadership in developing demonstration plots that compare various tillage systems.

Soil erosion in the state exceeds 100 million tons annually. About 75 percent of this occurs in row crop production areas, primarily in eastern and south central parts of the state. Increased use of soil conservation practices could prevent a large portion of this loss. But producers are reluctant to change their traditional farming methods and adopt conservation methods.

Although soil erosion occurs and is a concern, generally farmers have not seen corresponding yield decreases. In some cases, producers acknowledge that technological inputs such as fertilizer, irrigation, and improved hybrids are masking erosion losses. But, they are reluctant to change partially because they are farming the way their fathers taught them.

Conservation tillage is one of the most effective and least expensive methods found to reduce soil erosion. This practice leaves at least 20 percent of the soil surface covered with crop residues to protect the soil from wind and rain and to help prevent the movement of soil particles downslope. A 20-percent covering can reduce soil erosion by 50 percent—adequate for many farming situations.

Two Programs Evolve

Because climate and crop production differ in various areas of Nebraska, two major conservation tillage educational programs have evolved—ecofallow production systems centered in southwest Nebraska and moving into the south-central area, and conservation tillage for row crop producers, primarily located in eastern to south-central Nebraska.

Ecofallow farming methods, well adapted to lower rainfall areas, generally have a fallow period, where crop residues remain on the soil surface to conserve soil moisture. By adopting ecofallow methods, farmers can now produce two crops every three years in southwest Nebraska.

In eastern Nebraska, however, use of conservation tillage systems generally does not result in yield increases, thereby decreasing the incentive to change farming methods.

Extension conservation tillage educational programs in the eastern part of the state are encouraging farmers to adopt conservation tillage methods. Five major components of these programs include:

- Determining tillage and planting methods being used;
- Evaluating those practices, including advantages, disadvantages, and limitations of various systems;
- Developing educational materials for the targeted audience;
- Providing an in-service training program for Extension agents, Extension specialists and related agency personnel;
- Delivering the educational program to the target audience—primarily row crop producers.

Educational Materials Developed

As a first step in targeting materials needed to support the program, Extension specialists developed fact sheets highlighting advantages and disadvantages of basic tillage systems.

Winter in Nebraska. Standing corn stalks catch and hold snow on a farm; the use of conservation tillage reduces soil and moisture loss.

Left: A farmer in Gage County, Nebraska, does some minimum till planting in corn stubble. Below: A farmer in Colfax County, Nebraska, plants corn in bean residue.

The fact sheets also emphasized erosion control through residue management. A slide-tape unit containing similar information was developed for Extension agents' use. Extension specialists distributed additional fact sheets pertaining to weed control, insect and disease considerations, and economic comparisons to assist the producer in making tillage management decisions.

More than 240 Extension agents and Soil Conservation Service personnel attended an in-service training program, in 1980, covering various aspects of conservation. In 1982, over 150 producers attended a statewide conference on conservation tillage for row crop production. Evaluations of the conference were excellent—more than 90 percent of the attendees indicated an interest in attending a similar conference at a later date. Providing a proceedings as well as a producer panel to discuss their experiences with conservation tillage generated many favorable responses.

Program Efforts Expanded

To expand on the success of both the in-service training program and the statewide conference, Extension conducted six area tillage programs in February 1983. Also, an Extension agent within each area is taking the lead to develop conservation tillage demonstration plots.

In addition to meetings, several other methods promoted conservation tillage during 1982. At the University of Nebraska's annual Tractor Power and Safety Day, planters, drills and other equipment designed for use in conservation tillage systems were demonstrated. A rainfall simulator on loan from USDA-ARS at Ames, Iowa, demonstrated the magnitude of soil erosion from different tillage systems and corresponding residue covers. Producers attending these demonstrations compared erosion control potentials as well as equipment performance for different conservation tillage systems. Extension specialists also used television, radio, and news releases to help promote conservation tillage throughout the state.

Progress Slow But Sure

Although soil erosion continues to be a major concern in Nebraska, soil conservation practices are steadily increasing to help reduce this problem. In fiscal year 1981, more than 6.5 million acres in Nebraska were farmed with conservation tillage methods—a 20-percent increase since 1977. □

Pesticide Disposal—The Right Way

Mary W. Lomolino
Extension Community Resource Development Agent
Cooperative Extension Association of Broome County
Cornell University, Binghamton, New York

"DDT is stored in the basement of my new house, how can I get rid of it?" This question is frequently posed to the Cooperative Extension Association and the Environmental Management Council (EMC) of Broome County, New York. People often possess old pesticides (now banned from use) or materials they no longer want around the home because of the hazards they pose to children and pets. Whatever the reason, the easy solution is to put it in the trash or just flush it away.

Neither Extension nor the EMC was comfortable with the fact that, as a result of these disposal methods, the materials ultimately ended up in the county landfill or in wastewater treatment plants. It was likely that some toxic materials in the pesticides would leach into groundwater from the landfill, enter the Susquehanna River from the treatment plants, or become incorporated in sludge. Disposal of pesticides in the county landfill would only exacerbate an existing leachate contamination problem. Since the Susquehanna provides drinking water to downstream communities and disposal of treatment plant sludge is already a county problem, the option of flushing away unwanted pesticides seemed inappropriate. Alternative pesticide disposal methods had to be explored.

Through inquiries, it was learned that a pesticide disposal program for homeowners run by the NYS Department of Environmental Conservation (DEC) was no longer operating. This was due to budget constraints and more pressing hazardous waste problems. Homeowners requesting assistance from the DEC were provided instead with a list of registered hazardous waste disposal firms. Because these firms are geared to the needs (and budgets) of commercial customers, homeowners were left without any practical means of pesticide disposal.

Further investigation revealed that a fairly large store of pesticides existed at the Cooperative Extension office as it once served as a dropoff point for the DEC program. People were obviously still in need of a pesticide collection service.

It's registration time during "Pesticides Cleanup Day" when the Cooperative Extension Association of Broome County, New York, and the Environmental Management Council offered homeowners a one-time opportunity to dispose of unwanted pesticides.

A Time for Disposal

Extension and the EMC decided to offer homeowners a one-time opportunity to dispose of outdated or unwanted pesticides. Dubbed "Pesticides Clean-Up Day", the event was designed to educate people about the proper storage and use of pesticides, as well as to provide an environmentally sound means for their disposal. The plan was to collect pesticides at a central, easily accessible site for one day only. During that time a registered hazardous waste hauler would package them for eventual disposal at a secure landfill or for incineration.

Since this collection concept was new and untested, extensive planning was necessary to make the idea a reality. Six people, including Extension and EMC staff, EMC members and a student intern met regularly to plan the event. The plan included the following: contracting a hazardous waste disposal firm, choosing a date, obtaining funding, finding a site, securing necessary permits, and launching a publicity campaign.

Local industry helped to contact one of two hazardous waste disposal firms in New York State and helped convince the firm that their participation in this unique community service project was worthwhile. Fortunately, SCA Chemical Services, Inc., of Model City, New York, was so interested in the idea that they offered to collect the material on an at-cost basis and transport it back to their facility for a nominal fee.

Once a basic agreement was reached with the disposal firm concerning the services they would provide, a date for the activity had to be determined and funding pursued. A Spring date was chosen since many homeowners are gearing up for landscaping and gardening then and their awareness of pesticides is heightened. Several local industries were approached for funding and IBM and New York State Electrict and Gas responded with a monetary grant and provision of video services, respectively. The EMC also budgeted $1,000 for the project.

The Cooperative Extension office was chosen as the collection site since it is located near the interchange of the county's two interstate highways. Once the site was selected, applica-

Left, top: A volunteer engaged in pesticide disposal weighs material as chemist (right) classifies it before packing into appropriate drum.

Left, middle: Here, the chemist uses a manual to determine components. But a few of the collected materials were so ancient they pre-dated any manual at hand.

Left, bottom: A worker seals a drum filled with collected pesticides for transport.

tions had to be filed with the U.S. Environmental Protection Agency (EPA) for a hazardous waste generator number. Federal law mandates that this number be assigned to hazardous waste genertators (in our case, the collection site) so that toxic materials can be tracked from "cradle to grave."

To ensure that no last-minute problems developed regarding permits, the DEC and the Broome County Health Department were informed of our plans and activities.

Publicity was Essential

Good publicity was essential to the success of the collection efforts. People were encouraged not only to evaluate the condition and usefulness of their stored pesticides, but also to take time out of one particular Saturday morning to bring them in for disposal.

The publicity campaign was launched prior to the event by the County Executive. He proclaimed Saturday, June 19, 1982, as Broome County Pesticide Clean-Up Day at his weekly morning news conference. The announcement launched a day-long pre-arranged media blitz during which Extension, EMC and SCA representatives met with reporters from the press, radio and television. Other publicity was channeled through *Broome County Living* (Extension's monthly publication) and flyers distributed to garden and grocery stores.

Early in the planning stages it was recognized that to get adequate participation the collection would be publicized as a free service. Eventually, the service was offered at no cost to anyone bringing in less than 10 lbs. of powder or 1 gal. of liquid of any single pesticide. People could bring in, for example, 8 lbs. of DDT and 5 lbs. of arsenic compounds without incurring a charge. There was a nominal fee for any quantity over these thresholds to prevent small businesses, farmers and commercial applicators from overwhelming the project capacity.

Collection Day

On the morning of collection day, organizers met with the SCA chemist and waste handlers to set up the outdoor site. A heavy plastic tarp was put down to protect pavement from any possible spills. A registration table, scales and a classification table were needed for recordkeeping and material handling. Drums and packing material were located behind the tables away from the public.

"Some of these things are as old as I am," declared our first participant. While we doubted that his pesticides matched his 93 years, none of us felt that "Fly Ded" deserved a space on any gardening shelf. Fly Ded was an arsenic compound that pre-dated World War II. The SCA chemist designated the barrel for Fly Ded's disposal.

Chose Incineration

After 5 hours of collecting, workers had assembled nearly 500 lbs. of powder and 70 gals. of liquid pesticides from 98 county residents. The materials (including parathion, DDT, chlordane, lindane and 2,4,5-T) were separated into classes and packed in drums surrounded by absorbent materials. Since the pesticides collected were more toxic than anticipated, SCA decided to incinerate rather than landfill them.

The program objectives of increasing community awareness of pesticides and providing a means of disposal were fulfilled; however, another objective remained. It was hoped that other communities would consider sponsoring a similar event. With technical assistance from NYS Electric & Gas and Cornell Cooperative Extension, a videotape was produced outlining the planning necessary to sponsor a clean-up day. The tape titled, "Are Pesticides a Community Pest?", is available to community groups and agencies with an interest in the environment. A detailed handbook supplementing the tape has also been prepared.

The Broome County Pesticide Clean-Up Day gave citizens a meaningful environmental choice. They could retain unwanted pesticides in their homes, dispose of them in an environmentally dangerous manner, or take advantage of an opportunity to use our best available technology in toxic waste disposal. Fortunately, many people responded to this program and Broome County soil and water are better off as a result. □

Watershed Management Pays Extra Dividends

Rob Crowley
News Specialist
Cooperative Extension Communications Center
University of Massachusetts

"To a municipality, the forest may be thought of as principal and the annual growth and harvest likened to interest. The interest can be used to lower the municipal tax rate or offset the cost of water, or it can be reinvested in the forest with a predictable rate of return. So, forest management actually pays for itself and a healthy and productive forest watershed benefits the public."

—Warren Archey

What do you get when you turn loose a gang of college kids in the woods? A new country? A dozen Tarzans? A catastrophe?

The question is no joke and the answer isn't a punch line when you're talking about the University of Massachusetts Forestry Department.

For the past 5 years, students under Joseph Mawson's direction have inventoried watershed lands in several western Massachusetts towns. The towns—now numbering 16—are involved in a cooperative watershed management assistance program, the brainchild of Warren Archey, regional community resource specialist for the Berkshire County Extension Service.

A watershed is the land surrounding a reservoir that adds water to the reservoir through drainage. Every tree on a watershed uses water to survive, thus decreasing the potential yield to the reservoir. Theoretically, a paved surface sloping towards the water would be the most effective watershed. Of course, this would be unsightly and impractical.

Studies Completed

So far, studies have been completed on 25,000 acres of municipal watershed. Timber on these lands is valued at almost $12 million. Potential annual harvest done in all 16 municipalities would generate an estimated $380,000 revenue while enhancing water quality and quantity. Costs for the University studies were about $5,600, but done commercially, they would have totalled nearly $31,000. To date, income to participating towns exceeded $359,000 resulting in a total benefit (savings plus income) of more than $390,000.

Five years ago, the Extension specialist realized that most of the 220,000 acres of municipally owned watershed land in Massachusetts suffered from little or no management. This policy of "woodland anarchy," he found, was linked to a fear by most towns that tampering with the watershed might prove detrimental to the water supply and lead to forest destruction.

"It's been the assumption that if you do anything to the forest—harvest timber, put in roads, whatever—it's going to result in poorer water quality. But now, with contemporary forest management practices where a lot of thought is given to erosion control, you can manage the land and still have high-quality water," says Archey.

Development

Archey contacted officials in 21 towns in the four western counties of Massachusetts who maintained "hands-off" policies towards their watersheds. He had to do some convincing, but once he explained the benefits of careful management—increased water yield, timber to sell and a greater vaiety of plant and animal life—Archey had 16 converts.

Next he recruited Professor Mawson and willing students to do the actual legwork. The students, all seniors in forest management, met with town authorities to explain their intentions and obtain accurate maps of watershed lands—an often difficult task. Some towns had maps without property boundaries, or simply had no maps at all.

But with maps, aerial photos or the memories of old-timers to guide them, teams of young foresters ventured into each watershed to conduct a forest "inventory." The teams run "cruise lines" (straight lines through the woods used to measure trees at set intervals) to determine how much and what types of wood were on the land. The students also inspected each watershed for potential silt and erosion trouble spots.

Management Plans

Next they prepared 10-year management plans for each watershed. The plans included guidelines for improving the quality of water, the yearly removal of timber and estimates of the annual revenue towns could expect from the sale of lumber. In one instance, students estimated that the town of Dalton could expect $25,000 per year from management. The first year, the Dalton harvest produced $27,000, and the next, $29,000.

And in Chester, a town that believed it had no timber worth managing on its 774 acre watershed, students developed a plan calling for harvests of $8,000 worth of timber annually over a 10-year cutting period.

To improve water quantity and quality in western Massachusetts, Extension specialists and faculty and students at the University of Massachusetts team up to determine the density of various forest stands. After this, they removed selected trees from watershed areas. Trees use water to survive, but trees on a watershed (land surrounding a reservoir) decrease water yield to a reservoir.

Through an agreement worked out by Archey, each town paid only the travel and equipment expenses for students. Since neither Archey, the students, nor the university were profiting financially from the watershed projects, Archey and Mawson both felt that the towns would have confidence in the objectivity of the management reports. In other words, neither the Extension Service, students, nor the university would become involved in implementing the plans for a fee.

Since the program's beginning in 1977, Archey has hoped that each town, armed with new information about its watershed and a basic knowledge of forest management, will be able to decide on their own whether to hire a professional forestry consultant.

"Neutral, objective data provided by the university enabled towns to realize the worth of their forest resources. It was then a small step to become involved in management through a consultant," Archey says.

Benefits

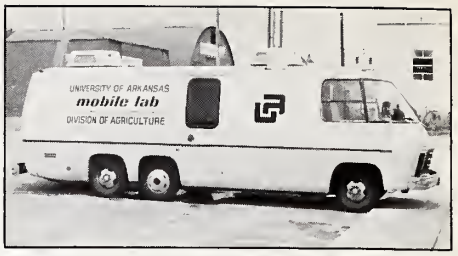
Of the 16 towns the students visited, four now have their watersheds (8,165 acres) under management. Many of the others, Archey says, are still considering what he calls "forestry with water production as a benefit."

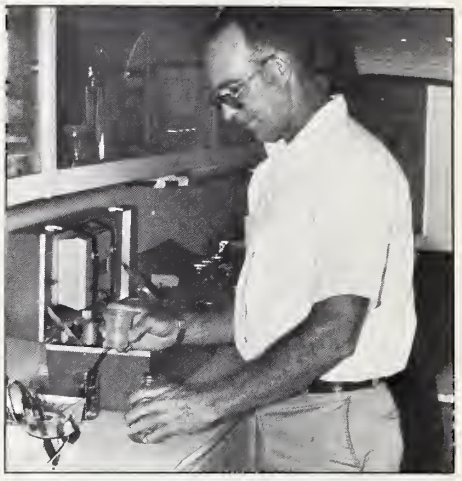
"Each situation is unique. What is common to all towns is the need for a continuing supply of water at the least cost. It has been demonstrated that forest management can be designed to improve timber growth and augment water supplies while maintaining water quality—and at the same time yield revenues," Archey says.

So if you happen to be hiking through the forests of western Massachusetts and see a small band of young people roping off a plot of wooded land, don't think they're seceding from the Union. It's probably just a bunch of UMass forestry students getting some on-the-job training. □

Testing . . . with a Lab on Wheels

Stanley L. Chapman
Extension Soils Specialist
University of Arkansas





A mobile laboratory – converted from a camping vehicle – tests irrigation water from wells for total soluble salts, and other factors that can harm crops. Extension specialists from the University of Arkansas drive the lab, supervise testing of one hundred samples a day, and make recommendations to growers.

Most of the irrigation water used in Arkansas comes from wells. According to USDA's Soil Conservation Service estimates, more than 18,500 wells pump over 3 million acre-feet of water annually for Arkansas crops. Water quality has become a problem in several locations. Long-term use of well water high in calcium and magnesium bicarbonates has created alkaline soil pH's near inlet areas of medium-textured rice fields. The resulting high pH causes zinc deficiency in seedling rice. Other wells are high in total soluble salts. The use of such water in some cases has damaged soils to the point of harming most crops grown on them.

Water Quality Concerns
State Extension specialists and county Extension agents interested in solving the increasing salt problem have developed an educational program to increase farmers' awareness of water quality. A University of Arkansas Mobile Lab equipped with water testing equipment has been used to test irrigation water for the last 3 years.

The Mobile Lab is a modified 1976 GMC recreational vehicle normally used as a camping vehicle. The interior was redesigned as a laboratory. Major features include extensive bench tops, storage cabinets, a ventahood, sink, numerous electrical outlets, and excellent lighting. Two gasoline generators provide electricity for lighting, outlets, and air conditioning or heating.

Although the University of Arkansas Diagnostic Lab at Fayetteville has been testing irrigation water for over 15 years, less than 15 percent of the state's wells have been tested. County Extension agents say, "Most farmers do not even consider testing their irrigation water until they experience a problem in growing crops on the land." One agent recalls, "I know a grower who lost three rice crops in a row before he recognized that his irrigation water was too salty to use." A few farmers test their water but in most cases, farmers know little about their water quality and what effect its long-term use may have on future crops.

Educational Efforts
The Mobile Lab is used to test water samples brought to collection centers by farmers in the area. The bulk of the testing is done in June or July when farmers' pumps are already running for irrigation purposes.

The Mobile Lab contains portable equipment that can quickly and accurately measure pH, total salts (specific conductants), total hardness (calcium plus magnesium), total alkalinity (carbonates and bicarbonates), and levels of iron, manganese, chlorides, sulfates, and nitrates. The number of tests run on an individual sample depends on the quality and use of the water.

Extension specialists drive the Lab, supervise testing, and make recommendations to growers. The specialist team consists of a fish and wildlife biologist, a soils specialist, and an agricultural engineer. Local Extension agents publicize, collect samples, do necessary paperwork, and, in general, administer the program in the county. Excellent local support from agricultural businesses, educators, consultants, and other agencies, such as the Soil Conservation Service, has helped to make the program a success.

Collection stations are established at one to five locations in a county. Primary agricultural travel centers, such as farm supply stores, shopping centers, and county courthouses, are popular locations. Farmers are notified of the date and time when the Lab will stop at each location.

Growers are encouraged to collect fresh samples in clean containers on the day of the testing. The number of samples collected at each location determines whether the farmers will receive their results and recommendations before the Lab moves to the next location.

Extent of Testing
Normally about 100 water samples are tested in a day's time. In some cases, collected water samples must be tested later, an undesirable situation because chemical changes can occur quickly. Generally, such changes are not great enough to mask overall quality of the water.

More than 1,000 irrigation water samples have been tested in the Mobile Lab since 1979. Ninety percent of these are from five counties. Agents in these counties use these tests plus results from other laboratories to delineate water quality boundaries. Most wells in a given area extend into the same aquifer or "water-bearing zone." Water quality maps are being developed to help predict what to expect from new, untested wells in the county.

Such information will help to avert deterioration of soil from salt buildup and to prevent the resulting agricultural disasters that have plagued irrigated lands. □

Making Sure It's Pure

Jerry L. Mosser
Extension Natural Resources Editor
Department of Agricultural Journalism
University of Wisconsin

Living by a lake or river has its benefits—fishing, swimming, boating, and picturesque surroundings, to name a few. But it can also present special problems—contaminated drinking water is one example. Many building sites near bodies of water have porous soils and high water tables. The result can be mixing of household wastes and drinking water supplies, especially when septic systems and wells are not in good working order.

High water levels such as this can cause problems for lakeside dwellers by contaminating drinking water with septic system effluent. Extension at University of Wisconsin is conducting an educational program for the state's many lakeside dwellers involving tapwater testing for drinking water quality.

Many Lakeside Homes

Wisconsin has many lakeside homes, and, for the past 5 years, University of Wisconsin-Extension has offered an educational program to inform lakeside dwellers of the likelihood of contaminated drinking water. George Gibson and James Peterson, water resources specialists in Extension's Environmental Resources Unit, initiated and conduct the program.

Gibson and Peterson's efforts are part of a growing nationwide concern about drinking water quality. One outcome of that concern is the federal Safe Drinking Water Act. This act requires that a long list of potential water contaminants be kept below specified levels in all public water supplies, including those of resorts, campgrounds, and restaurants. But the act does not apply to private household wells, the source of water for most rural residents and many small communities. Bacteria contaminated 29 percent of individual household water supplies tested recently across the country. Many more had higher-than-recommended levels of one or more contaminating chemicals.

Wisconsin's lake communities are generally more prone to drinking water contamination than other rural communities are, Gibson says. Besides sitting on sandy, porous soils with high water tables, many lakeside homes have shallow wells close to their own or a neighbor's septic system. Originally summer cottages, many of these homes also have a septic system that is inadequate for a full-time residence. To make matters worse, many septic systems have been in use longer than the safe working life they were designed for—about 25 years.

Samples Show Contamination

Typically, participants in the Extension drinking water program send in samples of their tapwater for testing, then attend community meetings to get the results and information about soils and groundwater in the area. The testing includes measurements of coliform bacteria, water hardness, and chloride and nitrate levels. So far, Gibson has checked water from 824 wells in 30 different lake and river communities. Nearly half the samples appeared to be contaminated to some degree. Luckily, no serious illness seems to have resulted from the apparent contamination. The water resource specialist says that tests do not prove that a well is contaminated, but they serve as a warning that the owner should have the water tested by a certified testing laboratory.

Extension specialists at other University of Wisconsin campuses help Gibson and Peterson conduct the drinking water program, and county Extension agents bring it to the attention of Wisconsin residents.

Broad Educational Program

Although an important service for homeowners, the water testing is the first step in a broader educational program. The overall goal is to make homeowners in contamination-prone areas aware of the need to have their drinking water tested regularly, preferably once a year. Gibson says homeowners must take the initiative because such testing is not required by state or federal regulations.

The program also aims to make homeowners aware of their responsibility in protecting the groundwater beneath them; it is a source of drinking water for them and their neighbors. Gibson is now designing a set of illustrated file folders to encourage participation. Each folder contains informational materials and space for personal management records. Gibson plans separate management folders for septic systems, wells, property, and watershed land use. □

Saving Water in Montana

James W. Bauder
Extension Soil Scientist
and
Larry D. King
Extension Irrigation Specialist
Montana State University

For Montana's farmers and ranchers, conservation and efficient use of available water is not merely a matter of good practice—it is a matter of survival.

With the exception of the mountain valleys, essentially all of the cropped lands in Montana have seasonal climatic demands for water which are greater than the amount of rainfall available during the growing season. That means either learning how to effectively use soil-stored moisture and rainfall probabilities or paying the price of irrigation. But irrigation doesn't solve all the problems—pumping, water, and labor costs necessitate conservation. The Montana Cooperative Extension Service has been doing its part to help both the dryland farmer and the irrigator with moisture conservation and profitable crop production.

Valuable Guidelines

The first step for dryland farmers was the development of water use-yield relationships for most dryland cereal grains in Montana. Years of research across Montana resulted in the 1981 publication of "Soil Water Guidelines and Precipitation Probabilities" for barley and spring wheat. The publication indicated just how much water was required to produce a crop. It also defined the amount of moisture that could be obtained from the soil for different soils and locations.

The publication also contains the rainfall probabilities at different locations in Montana. Putting these things together resulted in a tool that farmers could use to determine what the yield potential was for locations across Montana on a year-by-year basis.

A computer program called FLEXCROP contains most of the information summarized in the soil water guidelines publication and it leads farmers through step-by-step procedures to help them estimate production potential and input requirements. In fact, the program will tell farmers whether to crop this year or fallow and conserve more moisture. These procedures could be called water conservation through efficient cropping practices.

Many dryland small grain producers have taken advantage of this computer program which is available through AGNET. Montana is one of the six major partner states in the AGNET computer system. The grain producers use the program to help them make management decisions about crops to plant, seeding rates, fertilizer levels, and variety. These management decisions involving moisture conservation and efficient use highlight the entire issue of resource conservation facing Montana's dryland farmers.

Although Montana is primarily a dryland state, irrigation makes a significant contribution to the state's economy. The 19 percent of the tillable acreage which is irrigated in Montana accounts for more than 35 percent of the annual cash receipts from agricultural commodities. Farmers have been irrigating in parts of Montana for almost 100 years. The Montana Cooperative Extension Service has taken an active role in defining management practices that lead to water conservation and efficient water use. Again, the computer has proven invaluable in helping the Extension Service deliver information, and also in assisting the irrigator with the decisionmaking process.

The Washtub Monitor

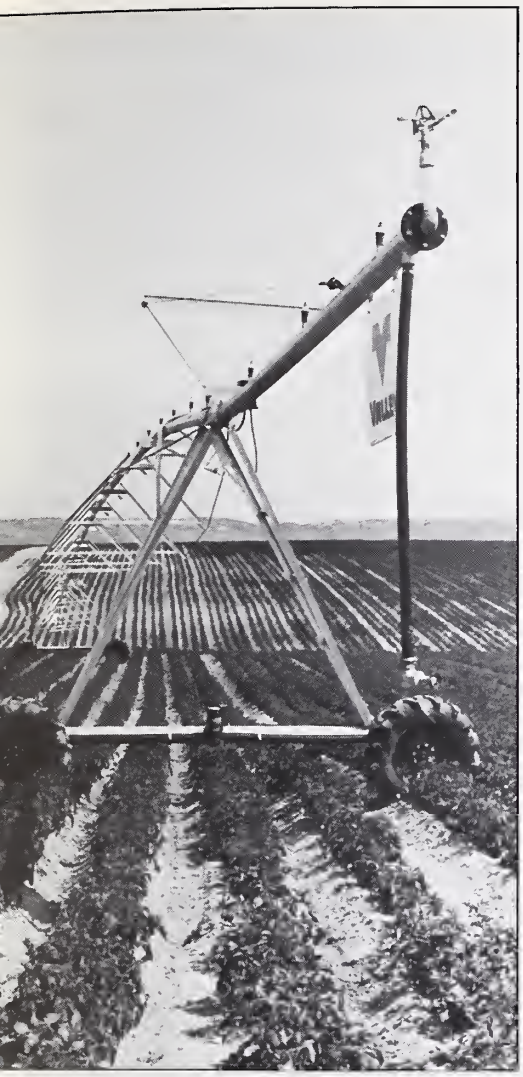
It all started with a simple "washtub." In 1971, two researchers with the Montana Agricultural Experiment Station, Sims and Jackson, reported that they were able to successfully monitor the rate of water evaporation from a water surface with a simple No. 1 or No. 2 washtub, rather than the expensive weather bureau evaporation pan. Gerald Westesen, an agricultural engineer with the Montana Cooperative Extension Service, then began an experiment using the washtub method to monitor the rate of water use by crops. The next stab was irrigation scheduling with a washtub. In 1978, when Westesen first reported on the use of the tub, he indicated it was a success that irrigators could readily understand and adopt without significantly altering their input. The method resulted in more efficient irrigation in both the amounts of water applied and timing.

Demonstration Project

In 1980, an extensive effort by the Montana Cooperative Extension Service to help Montana's irrigators improve their water management programs resulted in substantial water conservation. Spin-offs from this effort were impressive: reduced pumping requirements meant energy savings; significant reductions in fertilizer leaching associated with excessive irrigation resulted in improved production; and reduced runoff from irrigated lands paid off in soil conservation.

The program began with the development of a large-scale demonstration project, funded cooperatively by the Montana Cooperative Extension Service, the Montana Department of Natural Resources and Conservation, and the Teton and Cascade County Conservation Districts. Approximately 50 irrigators on the Fairfield Bench, an irrigation district 30 miles northwest of Great Falls, were invited to participate in a cooperative irrigation scheduling program. Each cooperator was encouraged to follow the guidelines and recommendations of the Extension Service, relative to irrigation scheduling. Three full-time field scouts were hired; they were assigned to work with irrigators, showing them how to effectively schedule irrigations.

In order to make the system work, and also make the system useful for irrigators across Montana, two computer programs were developed for use on



Left: A center pivot irrigation system in a Montana potato field; proper irrigation scheduling of such systems has a significant effect on water use and crop production. Below: A field scout records the depth of water in an evaporation pan in an irrigated barley field collecting important information about rainfall amounts between irrigations.

AGNET. The programs are called CONSUMPT and SCHEDULE.

Water-Use Information

CONSUMPT, available at all county Extension Service offices in Montana, is designed to provide water-use information to help irrigators, agents, and irrigation dealers advise farmers about how much water their crop is using. The program will handle 13 crops at the same time, and the user needs to keep track of the water use rate from one of the washtubs.

The SCHEDULE program is designed to actually do the irrigation scheduling for each field. The irrigator supplies information about soil, crop, and location. The computer requests information about the local weather, washtub readings, and soil probing information.

The irrigator then has the answers to the following questions: How much water is there in the soil right now? How deep are the roots and from where are they getting water? How fast is the crop using water right now? When should I irrigate again? How much water should I apply?

The computer keeps track of the farm record, and knows just how much water can be added without over- or under-irrigating. The result is proper timing and amount of water to apply.

Right on Schedule

The program is now working in 16 counties in Montana. Although the Montana Cooperative Extension Service does not have a means of getting an accurate accounting of the use of the system, we estimate that in 1982 more than 50,000 acres of irrigated land in Montana were affected by these efforts.

Whether irrigators think it is worth it or not is easy to answer. In 1982 the Montana Cooperative Extension Service surveyed 55 of its cooperators to determine their feelings about computer-assisted irrigation scheduling. Does it help conserve water, soil, fertilizer, labor, capital, and other valuable resources? They seem to think so.

It doesn't end there, either. Other things have been happening in the area of water conservation in Montana. In 1981, the Montana Cooperative Extension Service began an effort to assist Montana's surface irrigators (flooders) in improving on-farm water management. The purpose of this program is to determine the effects of improved water management on crop yields and on return flow quantity and flow quality from graded border irrigation systems. This is being accomplished by measuring both water applications and return flows, assessing water quality as it enters and leaves the field, and trying different application rates and set lengths.

Application Periods

Preliminary results indicate that over-application occurs because of labor scheduling conflicts. That is, farmers turn water onto the field and let it run for approximately 8 to 12 hours, before changing sets. This minimizes disruption of other, more pressing activities, such as harvesting. Extension Service studies have found that fields can be adequately irrigated with a 3- to 3-1/2-hour set, instead of the traditional 8- to 12-hour set. At present, the greatest drawback to improved water management practices is the impracticality of the shorter sets, because it requires changing sets at inopportune times.

This work is being expanded to include furrow irrigation methods on conventionally tilled and no-till planted corn. This should allow a determination of any significant management differences for furrow irrigation management techniques for these two tillage methods.

The project goal is to convince irrigators of the benefits of improved management practices and how such practices may improve yields, reduce fertilizer use, or enhance fertilizer utilization, minimize the effects of excess water applications, and minimize water quality degradation, resulting from excessive return flows. □

Protecting Soil In The Palouse

Carl F. Engle
Extension Soil Scientist
and
James S. Long
Staff Development Specialist
Cooperative Extension
Washington State University

Geologically, the Palouse soil is very young. It has been deposited in eastern Washington over the past 10,000 years by winds carrying silt and ash from a great dry basin in south-central Washington and from the Cascade Mountains, 200 miles west. The latest major addition came from Mt. St. Helens in May 1980.

The steep, silty Palouse hills are among the richest rainfed, annual croplands in the world, producing soft white wheats, dry edible peas, and lentils as major crops.

Cropping the rolling hills is costly in soil loss, however, caused by 15-25 inches of precipitation during the winter months when the slopes are largely unprotected. Soil loss reduces fertility, plugs drainage ditches along the roads, and fills the reservoirs behind the hydroelectric dams on the Snake and Columbia Rivers. Water is rushing our soil back west faster than it drifted east!

Tillage techniques are available to protect croplands and reduce erosion. But they are not being used universally. According to one estimate, one-quarter of the producers contribute three-quarters of the erosion.

Reaching Producers
How to reach those producers? That question prompted an educational project to reach producers with information about conservation tillage and to motivate them to try tillage techniques new to them.

Education Effort
It was known that producers who become aware of a new tillage technique would want to discuss the practice with experts and each other. An educational program was planned to involve delivery and interaction, using federal funds allocated to control nonpoint sources of water pollution.

A synchronized slide/tape set featured the evolution of tillage in the Palouse from animal power to high speed tractor power; available tillage practices; principles of soil management, field crop production, and economics that help producers evaluate each tillage practice; and experiences of producers in the Palouse who have tried conservation tillage.

This scripting effort came from a small group representing Conservation Districts, Soil Conservation Service (SCS), county Extension agents, and Extension specialists.

The production effort was contracted to a graduate student in Washington State University's (WSU) Adult and Continuing Education Program. After completing the slide/tape set, he made copies for county agents at six sites in the Palouse area of eastern Washington. An evening in January 1982 was scheduled for the program and agents invited producers from their counties.

Teleconference heads the Way
Meanwhile, on campus a group of Extension specialists assembled to participate by conference telephone in the January program. After producers had an hour to view the slide set and formulate questions at their sites, the telephone conference was activated, linking the field sites and the campus.

For another hour and a half, the specialists and producers discussed topics that concerned the producers: Soils and fertilizers, germination and yield, disease control, weed control, tillage equipment, and economics.

Another graduate student in Adult and Continuing Education who evaluated the program told us:

- The event attracted 60 producers, most of whom had tried conservation tillage techniques,
- It did not attract those less experienced with conservation tillage,

The Palouse region of the Pacific Northwest has both a unique topography and unique erosion problems because intense cultivation pulverizes the soil into finely ground particles that are easily washed away. To keep this silty Palouse soil producing Extension has developed an educational program that promotes conservation tillage techniques.

- The program introduced information new to even the experienced participants and stimulated most of them to ask for more information,
- Participants rated the slide show as "good" and rated the telephone conference even better.

Committee's Tool Successful

Since the January program, the "tool created by committee" is being adapted more for the ultimate target group. In one county, for example, the Extension agent adapted the slide show for presentation at an annual commodity meeting—a gathering that attracts a broad cross section of producers.

In two other counties, Extension agents adapted the slide set and teamed with Conservation District Supervisors to conduct neighborhood "mini-sessions." The slides on conservation tillage became part of a half-day program that also discussed, for example, the Payment-in-kind (PIK) Program. The series of winter mini-sessions were conducted with small groups of farmers and spouses in homes representative of the target audience.

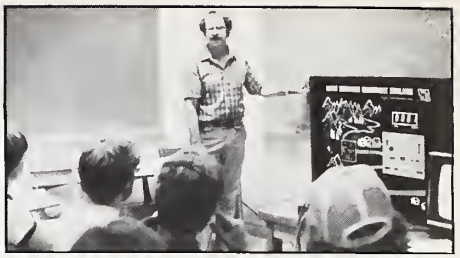
So, the diffusion process continues. It continues because of—

- Early cooperation among Extension, SCS, Conservation Districts, and Adult and Continuing Education in defining the message and the medium.
- Introducing the slide show to innovative producers and talking about its content with a mix of specialists and each other.
- Positive judgments about the quality of this educational tool.
- Ability and commitment of the Extension agents to adapt a slide/tape set in which they had invested and, with others, to play it again and again.

By collaboratively creating this slide/tape set, another step has been taken toward keeping soil producing in the Palouse. □

Education Through Computer Simulation

John R. Amend
Professor of Chemistry
and
Verne W. House
Associate Professor of
Extension Economics
Montana State University



Better management of the nation's water, energy, and electrical power and development of new technologies for them are essential. Ultimately, decisions on these resources are made by citizens and their selected representatives.

Computer Simulation
Interactive computer simulation is one way to help people understand the technical principles and relationships of a complex resource management system. They can also learn about some of the social problems involved in resource management. Computer simulation can place them in decisionmaking situations involving real problems and alternatives. No preconceived solutions are presented. Participants can experiment with different strategies and policies, and observe the probable consequences.

Interactive computer simulation can be illustrated with examples from work we have done in water management. The Water Resources Education Project was in cooperation with the Bureau of Reclamation, the Old West Regional Commission, the Cooperative Extension Service, and the Office of Water Resource and Technology. We initially developed the technology for the AEC/ERDA/DOE public education programs in energy. More than 100 Energy-Environment Simulators are in use in the United States and Canada today.

Simulating
The Water Resources Management Simulator is used in our water resources education workshops. We treat four problem areas: sources and quantity of water, uses of water, quality of water, and political management of the water resource. General hydrologic information is provided through a short slide talk. Workshop participants get a "hands-on" opportunity to develop and evaluate water management strategies through use of the simulator.

The Water Resources Management Simulator, a digital computer, can model a region's water supply and demand situation. Groups from the audience use remote consoles to make water management decisions on storage of surface and ground water, sources of water, rate of water use, technology of water use, and disposition of used water. Switches on the back panel weight the demands to represent the water use pattern in the region modeled. They also permit selection of a number of different ground and surface water conditions. Stream systems that are modeled in the current computer simulation program include the Gallatin, a high mountain stream typical of parts of Montana and Wyoming, the James in the plains of the eastern Dakotas, the Niobrara in Nebraska, the Suwannee in northern Florida, the Rogue River in Oregon, the Green River in Washington, and the Sacramento in California.

Real-Life Decisionmaking
Operators of the Water Resources Management Simulator must make some hard decisions. It provides them with snowpack and stream flow for each year that represent historical behavior of their region.

With their supply of water, operators must provide for their region's water needs—irrigation, energy, livestock, and municipal and industrial uses. They will want to prevent drought or flood from destroying crops or land. They will want to reserve adequate stream flow to support downstream users and fish and wildlife.

For each of their water uses, they must decide if the water will come from surface or underground water. They must decide the technology for each of their water uses. And, if they wish, they may flood some of their basin to create a reservoir for storage of surface water.

Unique Computer Simulator
The Water Resources Management Simulator differs from standard digital computer simulations in several ways. It operates in "real time" (approximately 8 seconds per month), and represents information on all of its variables simultaneously during the run.

Participants may interact with the model at any time, using simple controls to implement their water management decisions. As the simulator operates, a color graphic display of stream flow, water demand, and surface or ground water reserve is plotted on an TV monitor placed next to the simulator.

Workshop Structure
Participants learn by experimenting with the control variables and observing the effect on the overall system. The simulator poses problems, acts according to their decisions, and forces them to live with the consequences as time progresses. Through a process of successive trial, error, and optimization of variables, participants develop an understanding of the relationships between variables and of the alternatives involved. They also often change their idea of what is "optimum," after being faced with the realities of the system.

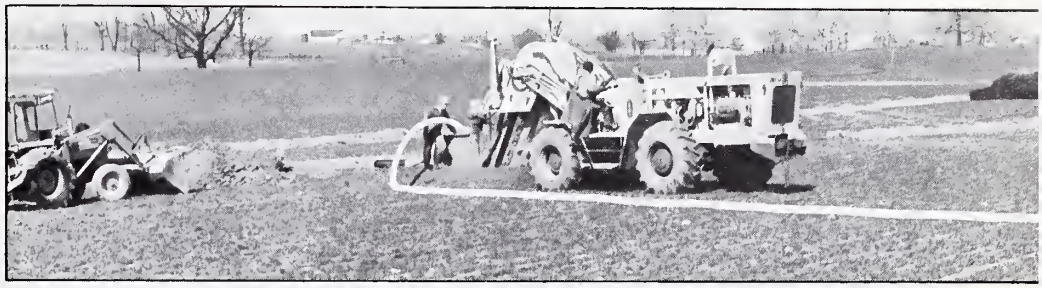
No One Point of View
A major advantage of the simulation technique lies in the fact that the workshop leader does not present a certain point of view. Participants can experiment with different strategies and policies and observe the probable consequences of different courses of action.

Our problem is one of increasing complexity of life. One could learn to plow by walking behind the ox, and to shoe a horse by working beside the blacksmith. But learning to fly an airplane or experimenting with energy or water management policy is far more difficult. Computer technology lets us experience these complex problems, and experiment with alternatives in a safe, low-cost manner. □

Training in Water Technology

Melville L. Palmer
Extension Agricultural Engineer
Water Management
The Ohio State University

A farm drainage installation in Stark County, Ohio.



Drainage is the major water management practice in Ohio agriculture. Contractors are assuming more responsibility for drainage system design and layout, since there has been a decline in both technical and cost-sharing assistance from USDA agencies. There is growing need for continuing education of drainage contractors in both technology and management as their enterprises become more complex. Almost 60 percent of our 11.7 million acres of cropland requires drainage for efficient crop production, and only one-third of this land has been drained to date. Other midwestern states have similar needs for drainage. About 25 percent of all U.S. cropland has wetness problems that require drainage for profitable production.

Changing Technology

Drainage technology has been changing rapidly during the past decade. New innovations such as laser systems, drainage plows and plastic drain tubing have attracted many young people into the drainage industry and stimulated experienced contractors to modernize their operations.

Technical proficiency in such fields as surveying with tripod levels and lasers, drainage system design, plan preparation, efficient machine operation, and equipment maintenance are basic. Business management becomes more important as the number of employees, the investment in equipment, and the volume and diversity of work increases. Programmable calculators and home computer systems are gradually becoming more significant factors in many contracting businesses. To be successful, a drainage contractor must develop good communication skills among employees, customers, and numerous others with whom there is frequent contact.

Since the early 1950's Extension agricultural engineers at The Ohio State University (OSU) have conducted annual educational programs for drainage contractors, in cooperation with the Soil Conservation Service and the Ohio Land Improvement Contractors' Association (formerly the Ohio Drainage Contractors' Association). The primary emphasis has been on one or more annual short courses 3 to 5 days in length, depending on subject matter and timing.

In 1979, these short courses were renamed "Virgil Overholt Drainage Schools" in honor of the late Professor Virgil Overholt who initiated the program of contractor education in Ohio. Professor Overholt retired from OSU in 1956 after 42 years of outstanding service.

Surveying a Basic Course

Throughout the 30 years of our drainage short courses (and schools), surveying for farm drainage has been basic to the program. The surveying schools involve about 30 hours of field and classroom instruction. Schools on drainage system design-installation involve a similar period of time. More than 1,100 drainage contractors, machine operators, drainage material suppliers and technicians have participated in these programs.

During the past 10 years (1973 through 1982), nine surveying schools and five design-installation schools have been held in Ohio, with an attendance of 537 people, 25 percent of whom came from states outside Ohio.

The purpose of the surveying school is "to advance the knowledge of drainage contractors and others interested in laser surveying for farm drainage." This is the only school of its kind in the United States.

The purpose of the design-installation school is "to provide continuing education for drainage contractors and others interested in advancing their knowledge of drainage system design, soil management for good drain performance, drainage materials, programmable calculators, and related subjects."

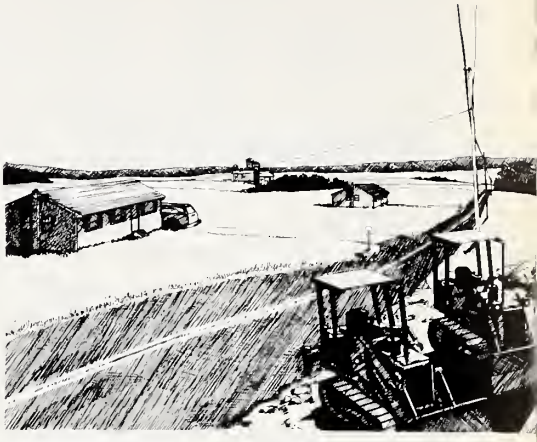
Laser Surveying

Continuing education for contractors is constantly being updated to meet current needs. A good example of this was the change from conventional surveying to laser surveying in 1982. Prior to that time, beginning in 1971, contractors were exposed to an increasing amount of laser instruction with the help of the Laserplane Corporation of Dayton, Ohio—the world's largest manufacturer of laser systems for earth-moving machines. There has been an increasing amount of instruction on soil and water management, including machinery and cropping practices that affect drainability of soil and soil structure.

With their practical working knowledge and expertise in soil and water management, informed contractors can greatly influence public attitudes toward wise use of our natural resources and good land stewardship. And farmers and others benefit by improved quality in drainage installation when they use the services of contractors who have attended these schools. □

Groundwater: The Vital Reservoir

Keith S. Porter
Senior Extension Associate
Coordinator, Water Resources Program
Center for Environmental Research
Cornell University, Ithaca, New York



Substantial irrevocable losses of farmland are often preceeded by a slight suburban encroachment into rural areas.

Half the population of the United States relies on groundwater for drinking water. In rural areas, more than 90 percent of residents obtain their water from wells and springs. Given the dependence on groundwater, deterioration in its quality is a serious issue.

Unfortunately, needs to deal with contamination are being only partially met. The quality of groundwater depends upon the recharge that replenishes it. Recharge itself is affected by multiple land uses and human activities on the land surface. It follows that to manage groundwater, it is necessary to manage activities which affect recharge. The alternative is to manage the water at the well or tap. Between what happens on the land, and what comes out of the well, management is practically helpless.

Framework

Public awareness of groundwater contamination has led to enactment of statutes that provide an initial framework for control of groundwater pollution. The dilemma for the lawmaker or regulator is that groundwater quality is determined by diverse actions on the land. How can laws and regulations govern all significant causes of contamination?

Causes include householders fertilizing their lawns, or pouring cleansing solvents down the drain, gas station operators washing their station's ramps, individuals improperly keeping domestic pets, and highway departments storing and managing salt for de-icing roads. Even if regulatory control of 80 percent of all the potential causes of problems were possible, the remaining 20 percent could still irrevocably damage the resource. For groundwater the *law of the commons* applies with special force.

A great deal of environmental management has been pursued through litigation. Litigation is costly and divisive. Both environmental and business interests bear substantial costs incurred by extended environmental litigation and regulatory reviews. Unfortunately it is not evident that litigation best satisfies either the parties to the conflicts or the environmental issues.

Where sources of contamination do develop, preventing contamination can also be costly. However, the longer term costs of inadequately preventing contamination may be much higher. There is a disposition to defer costs even when the result is a much greater cost later.

Problems in Rural Areas

About 40 million residents in rural areas depend on private domestic wells in addition to those using public systems. Groundwater is cheap and has always been considered reliable. Groundwater can be tapped adjacent to the point of use so no distribution system is necessary. It has not previously required treatment under normal conditions. In addition, groundwater represents an inbuilt storage system. Surface water usually needs storage and treatment which are difficult to control in rural areas.

Unfortunately, the security with which groundwater is used is now diminished. Where contamination occurs, households whose wells are affected can suffer a high degree of stress. Nonpublic water supplies receive little, if any, protection or support from health departments or other government agencies.

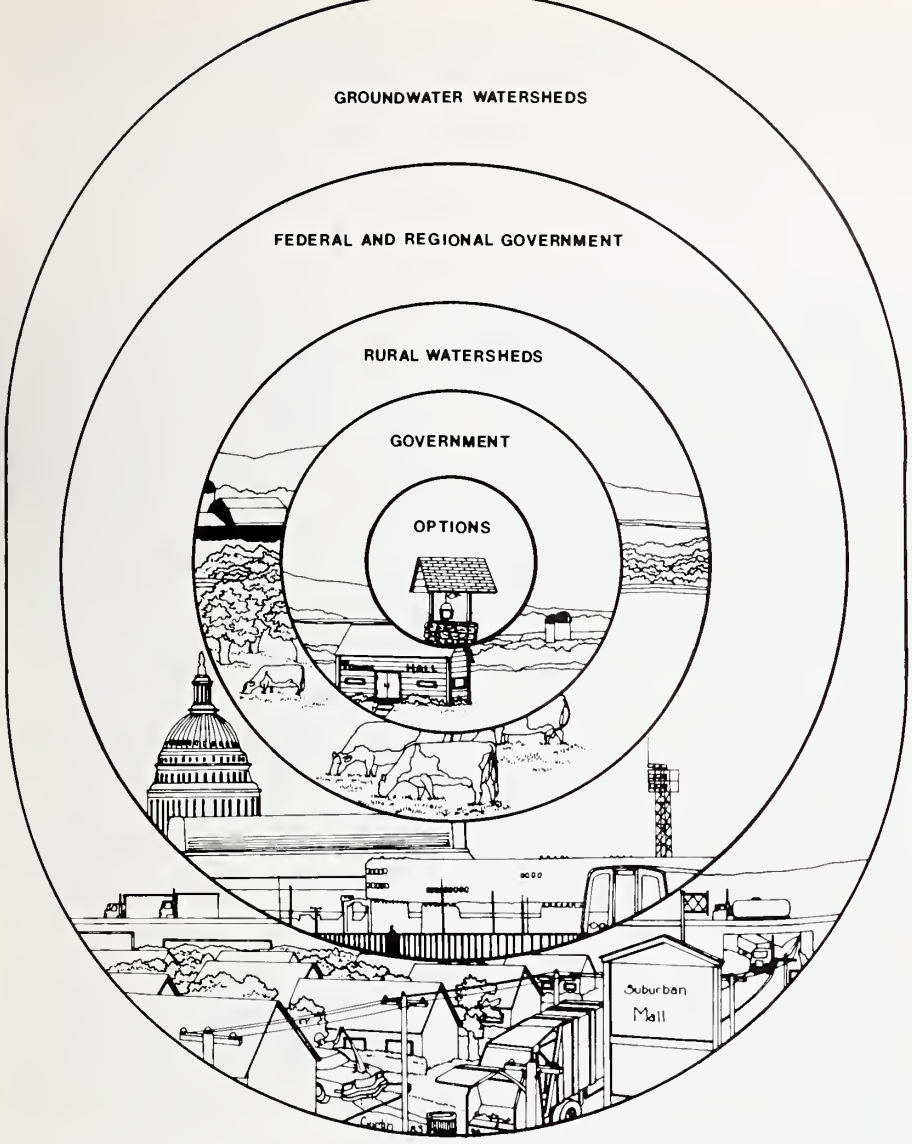
One solution advocated for many years is the development of public water supplies. Obviously, for many rural residents—those in remote districts, the rural poor, migrants and even weekend residents—this solution is not achievable. Also, although public water supplies are more reliable than private ones, they are not without problems in rural areas. For example, in a survey reported in 1970, it was noted that "smaller sized communities or systems had more water quality problems than the larger ones." Recently, the U.S. Government Accounting Office noted that small systems accounted for most noncompliance with Safe Drinking Water Regulations.

Need for Appropriate Answers

The inadequacy of rural waters stems from the lack of resources, and the use of inappropriate technology. During a conference sponsored by the National Rural Center there was overwhelming agreement that federal water programs were more suitable for urban than rural communities. Frequently, traditional and innovative technologies more appropriate to rural communities are underemphasized.

Organized water supply programs in rural areas may foster inadvertent, as well as intentional development. In some regions where staff from the Center for Environmental Research have provided assistance, real estate interests strongly support sewer and water supply construction. However, there may be less support for such water projects when other community residents become aware of the threat to farmland and their rural surroundings.

Work in areas in New York and rural communities in other states shows that the problems are as much institutional and social as technological. In rural areas there are no obvious candidate agencies to take overall charge and to balance competing economic interests.



This chart illustrates the complex overlapping issues of rural water management.

Problems facing rural communities in protecting groundwater, treating wastewater, and in managing water supplies require an *appropriate technology* combined with *nonregulatory solutions.*

Developing New Knowledge

Groundwater is rarely visible. Intuition seldom provides a reliable sense of how groundwater moves, at what speed and from what origin. There is even less appreciation of how actions on the land can cause a contaminant to eventually reach a drinking water well. This failing is compounded in situations where years elapse before the contaminant arrives at a well which is miles from the contaminant's original source. In addition, previously there has been a faith in the purity of groundwater, and in the ability of the soil to filter and cleanse water passing through it.

Testing with WALRAS

Although confidence in the protective capacity of soils has diminished, there remains the need to foster "better housekeeping" on the land surface. A little prevention now is an inexpensive substitute for a lot of problems later. To further understanding in communities, the Center for Environmental Research has developed evaluatory and educational techniques termed the Water and Land Resources Analysis System (WALRAS).

WALRAS has been successfully applied and tested under a variety of circumstances. Its effectiveness is achieved by forcing its users to systematically identify and assess problems using available data. The procedure uses simple budgets which summarize the different sources and fates of a contaminant, or water, in a given area and time, resulting in an understanding of the implications of both short-term activities and longer term development patterns.

For success however, it is essential to fully engage the community throughout the procedure.

The approach used in applications of WALRAS is to educate and inform while mediating between conflicting groups or individuals. In each of the areas where WALRAS has been used, considerable success has been achieved in developing institutional or social mechanisms whereby the needed work can be accomplished. This experience however has not so far included the deliberate aim to explore and establish the most *appropriate community arrangements* which are *self-sustainable.*

It clearly is impossible for all villages with water problems to receive individually the intensive support and technical assistance such as that so far provided by Cornell. The vital need is to determine the appropriate administrative and social mechanisms to allow villages and small communities to initiate and adopt the appropriate managements themselves. Community residents primarily determine what happens on their land, and how water supplies are managed. Extension programs could provide external support and assistance that will be required to achieve the necessary level of understanding.

Informing Rural Residents

The scattered distribution of residents in rural areas, the educational level, amount of time and interest, all limit ability to educate and inform the rural audience. Television and telecommunications are going to be increasingly effective as communication media in the next decade. For example, television broadcasting from satellites directly to low-cost individual home receivers will be widespread in many countries before the end of the decade. These satellites offer a cost-effective means of educating and informing the rural audience. □

Keeping Wisconsin's Groundwater Clean

Bruce Webendorfer
Extension Water Quality Education Specialist
and
Gary Jackson
Water Quality Education Coordinator
Environmental Resources Unit
University of Wisconsin

Wisconsin enjoys an abundance of clean, clear groundwater which is widely used for drinking, agriculture, and industry. But recent threats to its quality have greatly increased citizens' interest.

The result has been a challenge to University of Wisconsin-Extension (UWEX) to develop an education program for this complex, misunderstood resource.

Notable Cooperation
Noteworthy in the Wisconsin experience is the cooperation among faculty of many backgrounds and state agencies on a political, conflict-laden issue. That cooperation has enabled quick mobilization of limited resources to address high-priority public information needs.

Groundwater problems in Wisconsin are primarily local. Incidents of contamination have increased in recent years, from a variety of sources, ranging from pesticides, fertilizer, and manure storage to mining wastes, landfills, and hazardous waste disposal sites.
In 1981, several events brought groundwater concerns into focus. A special state legislative committee was evaluating the need for additional legislation on groundwater management. Monitoring showed scattered, increasing instances of pesticides and nitrate contamination. A controversial new rule permitted at least minimal degradation of groundwater from metallic mining, while an emergency rule restricted the use of the insecticide aldicarb (Temik), the most effective agent in protecting the state's $80 million potato crop.

Special Task Force Formed
A special UWEX Groundwater Task Force was formed in November 1981 to identify existing UWEX groundwater education programs and resources, suggest needed programs, and set an overall course of action for internal and external coordination of education activities.

The Task Force included 26 UWEX staff, representing 10 campus departments and 3 Extension community program areas (agriculture, natural resources, and home economics).

Meeting for the first time in December 1981, and issuing their final report on May 7, 1982, the Task Force assessed all groundwater issues in the state and identified the strengths and weaknesses of existing UWEX programs.

Initial Results
The Task Force, from the outset, served as a mechanism for internal communication and coordination. Faculty members came to recognize how their research and teaching programs relate to groundwater concerns. Administrative staff also became more aware of the need for education on groundwater. Limited resources could then be quickly obtained. Finally, the university's success in coordinating its internal efforts has improved its access to the ongoing legislative activity on groundwater.

Groundwater Program Activities
Following issuance of the Task Force report, program activities centered on—

- Gathering and synthesizing information into publications on the priority concerns identified by the Task Force;
- Developing education programs for UWEX staff, farmers, and the general public.

In line with Task Force recommendations, the Water Quality coordinator organized an ad hoc committee to identify highest priority publications, and coordinated efforts that resulted in small grants from Cooperative Extension and the Environmental Protection Agency to use in developing publications and other educational materials.

Publications Developed
Part of the grants funded use of four graduate students to work with Extension specialists as editorial assistants. They synthesized existing information, identified resource people, and wrote drafts for review.

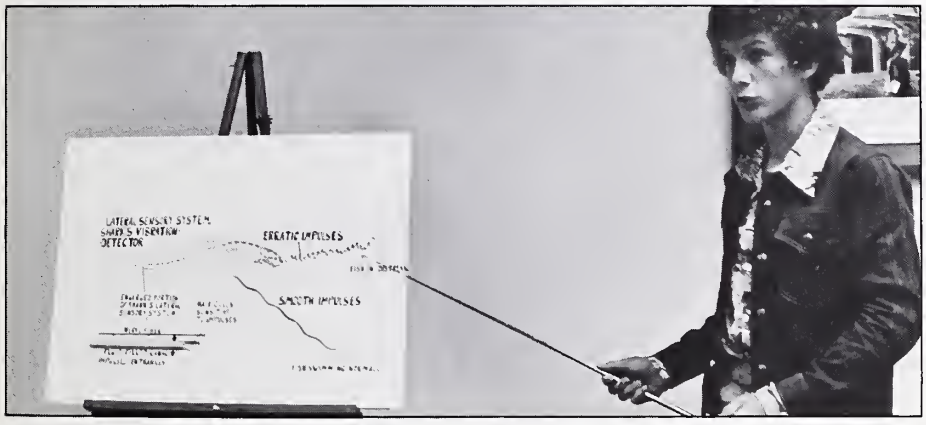
The program activities following the Task Force report have not only spurred internal coordination, but have also established the foundation for a broader cooperative effort on groundwater issues with regulatory and technical agencies.

Many Groups Involved
The number of agencies and offices with a role in groundwater regulation is as imposing as the number of relevant academic disciplines. Overall regulatory authority for surface and groundwater quality rests in the state Department of Natural Resources, whose groundwater functions are spread among functional and regional offices. Other agencies regulate some important activities affecting groundwater quality. The state Department of Agriculture, Trade and Consumer Protection regulates pesticide use, the Department of Health and Social Services evaluates health effects and recommends acceptable limits of contaminants in drinking water, and the Department of Industry, Labor and Human Relations regulates the siting and design of septic systems.

Tangible Results
At this time, 9 months after the Task Force issued its recommendations, UWEX can point to tangible results: 10 publications in press or in review, an internal white paper on irrigation management education needs, a slide show and a display, two agent training programs, and several public information meetings. A start has been made toward translating one of the Task Force's less tangible recommendations—"substantial interagency cooperation and coordination"—into reality. □

Time and Tide—4-H Marine Science

Stu Sutherland
Public Information Officer
Extension Service, USDA



Top: 4-H'ers enjoy the 21 exhibits at the Marine Fair, held in conjunction with the Marine Institute at Marineland, Florida. Above: A 4-H member lectures on the sensory system of sharks at the 4-H Congress held at the University of Florida.

One bright, new and expanding group of 4-H project activities centers attention on the sea and the shores. Commonly known as 4-H Marine Science, this program is gaining popularity in states with Sea Grant staff and facilities.

To glimpse at the diversity of this program, here's a "skipping rocks" look down the eastern seacoast, and a glance at the far northwest.

New York Holds Marine Camp
New York held a 5-day Marine Camp in Nassau County in July 1982. The program for youth aged 12-17 provided 51 young people with an introduction to marine biology, astronomy, maritime crafts, recreational fishing, career exploration, and seafood utilization.

Each of the participants paid $100 for meals and housing, with $3,000 for additional expenses from the state's Sea Grant program. Five Cooperative Extension agents who staffed the camp program now provide marine-related projects in their counties.

One of the camp's objectives was to acquaint county Extension staff with the expertise of the Sea Grant program so that it could be used to support local leader training efforts. Other objectives included making youngsters aware of the marine environment and the role that it plays in their lives, with particular emphasis on economic development—including career exploration—and ecological balance.

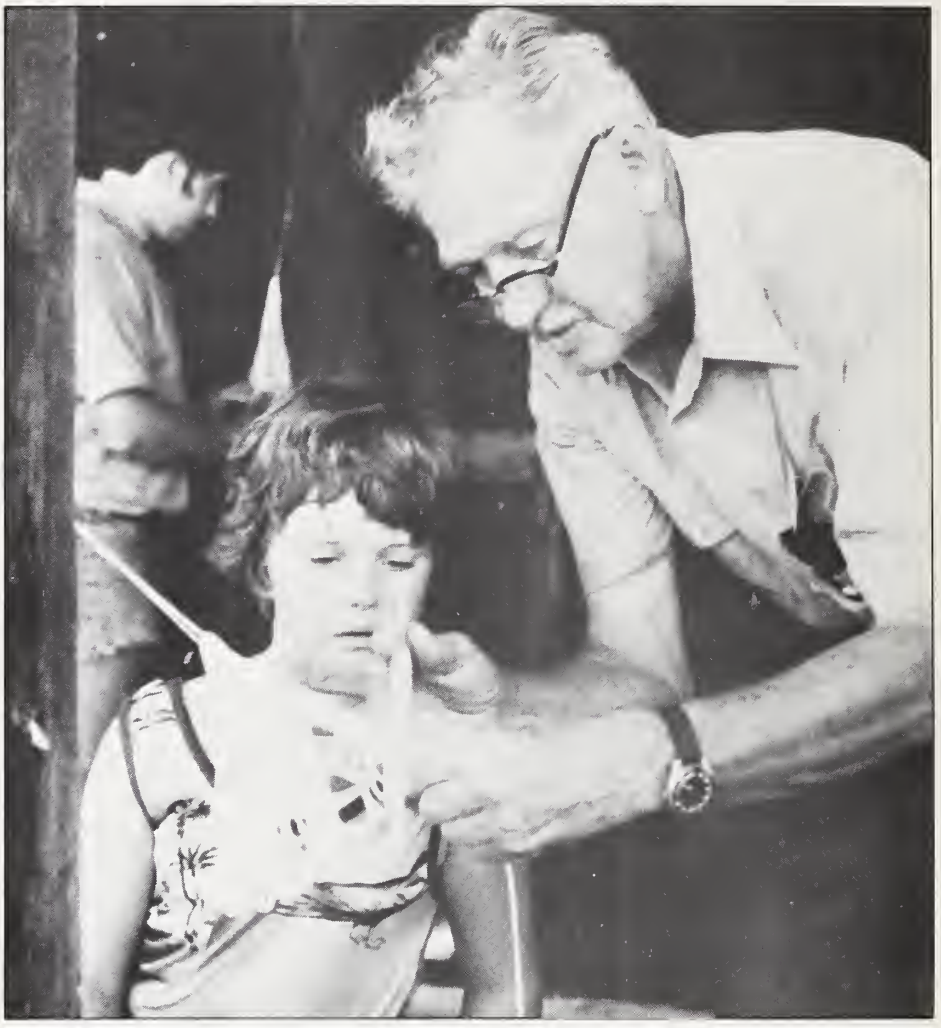
This July (1983) a second camp will be held with more youth involved. Seven youngsters from the migrant program attended last year, and this year scholarships have already been provided so that some inner-city youngsters from New York City will have their first chance to attend. Plans are already being advanced to firm up this camp's activity and expand it to spring and fall periods when the camp is not booked solid.

Lobster on Wheels
Called the "Blue Lobster", 4-H coastal education in Rhode Island is mobile. Innovations for this program include the use of a trailer in the summer phase, and specially designed movable tanks containing sea life for winter programs in schools. In the winter phase, for K-6 grade school children, lessons include mammals of coastal areas, foodwebs, ocean flora and fauna, as well as others.

The impact of the "Blue Lobster," giving public access to coastal education for 4,000 in summer and 13,000 in the winter school program, is enhanced by providing 4-H promotion and awareness and in-school acceptance of 4-H.

The "Blue Lobster" is booked about 6 to 9 months in advance, and has already traveled to over 100 schools. The program operates at about $1 per student—similar coastal educational programs would cost around $5 to $6 per person. Teacher evaluations indicate a high degree of lesson retention, especially regarding the handling tank activities.

Below: Little marine student is drawn by net-making project at 4-H Marine Camp. Bottom: 4-H'er at the Florida Marine Camp becomes skilled at the messy but necessary skill of fish cleaning.



Marine Science Weekend
For the third year (in 1982) a special marine science weekend was planned and conducted for youth at the Seaville Consortium facilities.

Here young people gained an insight into the problems associated with erosion and industrial pollution, as well as by participating in a hands-on experience with a number of marine specimens and viewing microscopic life. Many of them had never experienced the shore area as a classroom.

Organized with the cooperation of New Jersey's Sea Grant Extension Service and the Consortium, the youngsters learned about a new variety of career possibilities. Their written evaluations show that several were contemplating careers in related fields.

There were also expressed interests and enthusiasm in the evaluations, so future marine science weekends are being planned.

Maryland 4-H'ers Use Research Ship
The Queen Anne County 4-H program arranged for a 2-day trip on a ship for 25 high school youth interested in underwater investigation. They used the resources of a University of Maryland Center for Environmental and Estuary Studies high technology underwater research vessel which can accommodate about 50 passengers. The 25 youth got some special attention as they gained knowledge of scientific investigation methods, gained appreciation for aquaculture, and the impact of land use on marine life. They also developed skills in mapping, data collection, water sampling, and a host of other new skills including marine life identification.

The 2-day trip also created much local interest and excitement, enough so that a week-long marine education camp is now being planned for the summer of 1984—with the research vessel being only a small part of the camp.

Elsewhere in Maryland, Wicomico County initiated an oyster culture project so youth there could learn skills related to the production, harvesting, and use of oysters. Such natural resource programs are being expanded in the Maryland 4-H program with renewed emphasis and interest in the Chesapeake Bay that is so much a part of the state's way of life, and with the support and training of volunteers.

Virginia 4-H'ers Get Involved
The Chesapeake Bay is also a part of

the scene in Virginia where last year 2,084 4-H'ers, 150 leaders and staff in 19 counties were involved in marine science education. One 4-H marine camp was begun in 1982, and nine educational modules developed along with drafts for two field manuals.

An average of 60 percent of the participants showed an increase in knowledge resulting from their marine science program experiences, according to pre- and post-testing. Programs on inland and fresh water areas are being developed to further expand Virginia's water-related 4-H activities.

Crabbing, sailor's "salty" knowledge, and snorkeling tips were all ways of the sea 4-H'ers will possess forever after 4-H Marine Camp.

Florida 4-H'ers Dive Into Program

Figures for 1982 4-H marine projects and activities in Florida show that more than 4,500 youngsters dove into all sorts of activities in their state.

In Polk County, Florida, the 4-H Advisory Board had expressed concern about the lack of public understanding of management of water resources. They established a 4-H Water Resource Education Committee with a main goal of creating awareness to all of Polk County's 4-H members.

The committee prepared a resource list for local 4-H leaders, and conducted tours, workshops, and contests for 4-H youth. Local 4-H clubs and leaders used the resource list to plan local educational experiences. As a result of all this activity and interest, Polk is now one of four Florida counties piloting (and doing a critique) of a new "Water in the Home" project for possible use statewide.

Program Redesigned

The Washington State 4-H Natural Resources program is going through a comprehensive redesign. The objectives, to be completed by fall of 1985, include a literature redesign for marine science (as well as other areas) with an emphasis on leader material; training of agents and volunteer leaders; an evaluation of the new designs; and the building of a learning center to reflect the natural resources curriculum.

To accomplish such a goal they will need to raise $400,000 over the next 4 years. To date, $71,000 has been raised for program development and $65,000 to help build the learning center. They also developed three curriculum prototypes, have involved more than 10 organizations, and also involved two Extension committees in their development effort.

Additional hopes are to hire a natural resources specialist for guidance. The long-term implications would be to increase the number of 4-H members in natural resources projects to 10,000 and the number of leaders to 800.

Conclusion

As mentioned earlier, this has been a "skipping rocks" look at a few of the 4-H/Marine Science/Sea Grant projects and programs that are developing. We have "skipped" a few states with Sea Grant and 4-H connections and hope to be able to include them in a future issue. Through these new and increasing 4-H programs and projects, more and more youth and their volunteer leaders will be able to more fully understand our lands and waterways and to help conserve them for future generations. □

Preventing Texas from Going Dry

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College Station, Texas

Texas is running out of water. Demands for this precious resource are so great that water has become the number one concern of many of the state's government officials and leaders. The governor's Texas 2000 Commission has tabbed water the top concern in the state, and Texas A&M University's Target 2000 Project has cited the need for programs on water use and conservation. The concern about water has been real for years and has long been a priority educational program of the Texas Agricultural Extension Service. In the Extension Service "Thrusts for the '80s" program, land and water resources is one area targeted for extensive educational programming.

Agriculture uses 70 to 75 percent of the state's water, so Extension programs have been aimed at helping farmers conserve water and use it more wisely. Extension efforts in crop irrigation began in the late '40s when the first irrigation specialist was hired to work in the High Plains area. Today, three Extension agricultural engineers headquartered at Lubbock, Fort Stockton and College Station provide information to help producers grow irrigated crops more efficiently.

Early educational efforts were directed toward improvement of irrigation systems and management practices to reduce the large amount of wasted water—flooded ditches and roads were common in many irrigated areas. Today, programs emphasize refinement of irrigation application systems, techniques to precisely time irrigation and methods to evaluate and improve the performance of irrigation pumps and power units to reduce energy use and irrigation costs.

Reducing Irrigation Water

Leon New, agricultural engineer at Lubbock, works closely with county Extension agents and farmers in the High Plains and Trans-Pecos areas which boast most of the state's irrigated cropland. New is concerned with reducing the use of irrigation water as well as reducing pumping costs.

"Farmers can ill afford to run wells now the way they did when fuel was cheap," New said. "We are working with them on fewer irrigations, different methods of irrigating and checking pumps for efficiency of operation to get the most from every drop of water they pump."

For instance, fewer irrigations used less water and produced 100 more pounds per acre of sugar beets in a 6-year demonstration in Deaf Smith County. Similar results have been found with corn.

Studies show that poor engine and pump efficiency can increase irrigation fuel costs as much as six to eight times. Efficiency tests on pumping plants have helped producers almost double their unit's operating efficiency, thereby reducing the fuel cost per-acre-inch of water by more than 60 cents.

Another study found three inefficient irrigation engines costing a farmer $28,000 a year in extra fuel costs.

Sensors Determine Moisture Levels

New also demonstrates the use of soil moisture sensors to help growers determine moisture levels. He works with producers to adapt center pivot sprinkler systems to ultra-low pressure operation, improving application efficiency to 95 percent or more and cutting fuel costs.

Cotton production in the Trans-Pecos area depends heavily on irrigation, and special efforts have been under way in that region to reduce water use as well as overall production costs. A special educational program, called ECONOCOT (for economical cotton production), was launched several years ago. Through more careful attention to various production practices as outlined by the ECONOCOT program, farmers have reduced their costs while conserving precious water supplies. Some have reduced irrigations by 50 percent.

Control of weeds and brush on Texas' vast rangelands (one-half of Texas is rangeland) is a leading factor in conserving available soil moisture, particularly in low rainfall areas. "Effective use of herbicides and other weed and brush control practices, combined with wise grazing management, go a long way in improving forage production for livestock," said Tommy Welch, range specialist.

Brush and grazing management can improve grass cover which uses available water more efficiently and can also improve the quality of surface runoff.

About 100 grazing management and brush and weed control demonstrations are established each year to help ranchers observe and learn about new and improved techniques and practices. Through field days, tours, meetings and workshops, some 20,000 individuals annually receive information to help them improve water use on their ranches.

Springs and streams are flowing once more in some areas where heavy brush infestations have been controlled and proper grazing management practiced. This attests the fact that brush control and good management are water-saving practices.

Bill Knoop, turfgrass specialist located at Texas A&M's Research and Extension Center at Dallas, has been instrumental in organizing an extensive educational campaign to reduce water waste on lawns.

Leaflets for Homeowners

Several years ago Knoop helped Plano officials cope with rising energy costs

and water use. The utility company mailed out "Waste-Saver Lawn Care Plan" information leaflets advising homeowners how to water their lawns and landscape plans properly. This led to water savings and reduced the tremendous amount of grass clippings that had to be handled by the city sanitation department. Reduced grass clippings alone saved the city about $59,000 the first year.

Since that initial effort, turf specialists have been busy advising city officials throughout the north Texas area on water-saving techniques and proper lawn care to reduce water use. More than half a million leaflets were distributed last year, half of them to Dallas residents. Other cities participating in the waste-saver program include Tyler, Garland, Carrollton, Denton, Hurst, Arlington and Wichita Falls.

Proper lawn management and watering have enabled homeowners and municipalities to reduce water costs—as much as 40 percent in some cases.

Extension's involvement in water issues came to the forefront this spring when the city of Gatesville began to experience water problems, with several wells going dry. Gatesville city officials worked with Extension staff members in a countywide educational program on water conservation. Town meetings on water use in and around the home were followed with mailings of "waste-saver" leaflets to some 7,000 homeowners.

Reducing Home Water Use

Along with proper watering of lawns and gardens, educational efforts in Gatesville focused on reducing water use in the home. Water-saving practices included repairing leaking faucets and toilets, using flow restrictors on shower heads, washing only full loads in washing machines and dishwashers and displacing some of the water volume in toilet tanks so less water is required.

Attention to minor drips and leaks is important because they can lead to big water losses. For instance, a faucet dripping at one drip per second amounts to 7 gallons of water a day, or 2,555 gallons a year. That's enough to flood a football field an inch deep.

Texas' escalating population, expected to surpass the 20 million mark by the turn of the century, will continue to put increasing pressure on the state's water resources. The Extension Service continues its educational efforts on wise water use and conservation for Texas citizens. □

Nonpoint Source Pollution—A People Problem

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Cooperative Extension Service
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Kenneth E. Pigg
Associate Professor, Sociology
Cooperative Extension Service
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Reduction of agricultural nonpoint source (NPS) water pollution is the task assigned to states by section "208" of the 1972 Federal Pollution Control Act (P.L. 92-500). Wilbur Frye, an agronomist, and Kenneth Pigg and Frank Clearfield, two Extension sociologists, are presently in the process of developing a "208" educational plan in Kentucky. Because Kentucky is one of the last states to produce such a plan, Kentucky specialists have the advantage of learning from the experiences of other states.

One unique feature of the program is that Kentucky is the only state to have a sociologist, Frank Clearfield, as the "208" educational program coordinator. According to a national survey of "208" coordinators gathered during the summer and fall of 1982, there are 21 agronomists, 8 natural resource specialists, 7 Extension administrators, 6 agricultural engineers, 4 state agency personnel, and 1 entomologist who coordinate "208" programs.

Pinpointing Problem Areas
Like most states in the southeast, Kentucky exceeds the generally accepted soil erosion level of 5 tons/acre/year; the state average is 9.4 tons/acre/year. Soil losses in the northcentral or "Bluegrass region," although still above the tolerant level, average only 6.1 tons/acre/year.

By contrast, the "Purchase Area" of southwestern Kentucky loses 15.2 tons/acre/year, which translates into 11.4 million tons of erosion annually.

Two factors will assist in making the educational plan effective. First, educational resources need to be allocated according to the intensity of the problems in a region. Second, since "208" is concerned specifically with NPS water pollution and not soil erosion in general, our first priority might be to target information to farmers who have acreage adjacent to water systems in areas which may be designated as "Water Quality Corridors."

Using Social Science Information
There are a variety of other factors we are considering before producing a final educational plan. Some of these include reviewing plans of other states, identifying solutions to NPS pollution problems that are economically acceptable to farmers, examining the principles of attitude change, applying principles of communication research to the different audiences that will be targeted in our "208" plan, and assessing socioeconomic background characteristics of farmers .

These last three considerations may be somewhat unique for "208" plans in that these research areas are grounded in social science information.

Portions of the plan will be developed by agronomists, agricultural engineers, and agricultural economists.

When you stop to think about it, using both natural and social scientists on pollution abatement educational projects makes sense, as pollution is as much a social problem as a technical problem.

Need for Awareness
Indeed, for a "208" plan to be truly effective, it first needs to raise awareness about NPS pollution and isolate it as a problem; second, it is important to transfer to farmers, conservation personnel, and policy makers knowledge of recent research on the complexities of NPS pollution; and third, it needs to change farmers' attitudes about adopting conservation practices

National Survey
One example follows. Data from the Kentucky national survey of "208" program coordinators showed that 39 percent of the 46 coordinators who responded to the survey felt that a general lack of awareness has been the biggest obstacle to the success of their programs. Raising awareness is most efficiently accomplished by using nonpersonal forms of communication such as television, radio, public service announcements, news releases and so on. Fifty-six percent of the coordinators who cited awareness as being problematic used these forms of communication as their primary source, but only 18 percent felt these were their most effective techniques. The remaining 82 percent felt personal contacts and slide presentations were most effective.

Research indicates that personal contacts are effective for communicating an understanding of details and changing attitudes, but not for raising awareness on a large scale.

Future Plan
Kentucky's educational plan will be finalized by August 1983. It will contain a mix of information from the social and natural sciences. Specialists have completed some major steps that include technically assessing the worst problem areas; conducting a representative statewide survey that determines the farmers' perception of water quality issues along with their personal and farm characteristics; and gathering ideas, strategies, and materials from other programs.

In the final version of the plan, the approach will be varied by state region and by audience (farmers, policy makers, or agency personnel). At the bottom line, however, farmers are the only group that can implement conservation practices. Regional "before" statistics that exist through our land grant university and state conservation agencies will be compared with similar indicators following the implementation of the plan. This yardstick will provide a gross indication of which strategies seem to work and which require some modification. The Kentucky staff hopes to find that using social science research systematically for a pragmatic project such as "208" will be an effective way to minimize NPS agricultural pollution. □

Pollution Control And Production Efficiency

James B. Atkins
Extension Specialist, Biological and Agricultural Engineering
North Carolina State University, Raleigh

Two privately owned farms north of Raleigh in the Piedmont of North Carolina are being used in an ongoing Extension program to demonstrate how control of agricultural nonpoint source (NPS) pollution can increase production efficiency. The program is being conducted by staff in the Biological and Agricultural Engineering Department at North Carolina State University in cooperation with a state task force on agricultural nonpoint source control.

This work stems from the 1972 Federal Water Pollution Control Act amendments. Specifically, Section 208 requires states to develop water pollution control strategies including those for agricultural NPS pollution. In North Carolina, the major agricultural NPS pollutants are sediment, nutrients, animal wastes, and pesticides.

BMP's Reduce Losses
A goal of the Statewide Agricultural Task Force Program is to increase awareness of the costs and potential impacts of NPS losses from North Carolina's cropland and farm operations. The program also encourages the voluntary implementation of Best Management Practices (BMP's) by individual producers to reduce these losses. BMP's generally recommended across the state include: soil and water conservation, optimal fertilizer use, animal waste management, and integrated pest management. Although these different practices are each part of ongoing Extension and USDA programs, they all fit together into integrated farm management system that increases efficient on-farm production and clean water.

Farm Demonstrates Effectiveness
The demonstration farm developed as part of the NPS Task Force Educational Program has succeeded in emphasizing the production agriculture and water quality benefits of recommended BMP systems.

During 1982, runoff from the demonstration and comparison fields was monitored to collect information on the effectiveness of the recommended BMP system.

For the farm serving as a comparison or control site, soil testing is the only management practice being used. Soybeans are planted continuously and tilled conventionally straight up and down the slopes. Soil type is a Cecil sandy loam and data are collected from a 10-acre field.

The demonstration site, on which many BMP's are used, is owned by Huel Choplin and his son Connie and is located a few miles from the control farm. They produce swine in a farrow-to-finish operation with 100 sows and grow grain for feed on the 100-acre operation. The 18-acre field being monitored has an Appling sandy loam soil. BMP's on the Choplin farm include:

- Soil and water conservation practices based on the need to meet soil loss goals—parallel terraces, grassed waterways, field borders, winter cover crops, and conservation tillage.
- Three ponds to store runoff for seasonal irrigation needs.
- Annual soil testing to assess nutrient and liming needs.
- Storage of swine waste in a liquid slurry pit.
- Testing of the swine waste to assess its nutrient value prior to land application.
- Land application of waste to meet crop fertilizer requirements based on soil and manure test results via a traveling big gun irrigation system.
- Irrigation scheduling based on crop and soil moisture conditions.

BMP's Pay Off
Annual losses during 1982 were less from the Choplin farm with BMP's compared with those on the control farm:

- Water runoff reduced from 176,000 gallons per acre to 93,000 gallons per acre;
- Delivered sediment loss reduced from 14.7 tons per acre to only 0.05 ton per acre;
- Loss of organic material reduced from 1,370 pounds per acre to 82 pounds per acre;
- Total nitrogen loss reduced from 38.2 pounds per acre to 7.8 pounds per acre;
- Total phosphorus loss reduced from 12.6 pounds per acre to 2.4 pounds per acre.

On Choplin farm in North Carolina, farm swine waste is applied over grain sorghum using their traveling irrigation gun system. This is one of two demonstration farms being used in an Extension program to show how control of agricultural nonpoint source (NPS) pollution can increase production efficiency.

These results show how many valuable resources can be lost from poorly managed cropland, and how well a complete management system can make production agriculture more efficient and protect water quality.

High Yields and Low Bills
The Choplin's management is paying off. From 1978 to 1981, they were Wake County corn champions and in 1981 ranked fourth in North Carolina. Their top yield was just under 214 bushels per acre. In addition, an increased level of soil testing along with testing of their swine waste for its fertilizer value and optimal land application allowed them to reduce their fertilizer bill from $10,000 in 1981 to $2,000 in 1982.

The Choplins are helping to show farmers across North Carolina that management and conservation pay. □

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